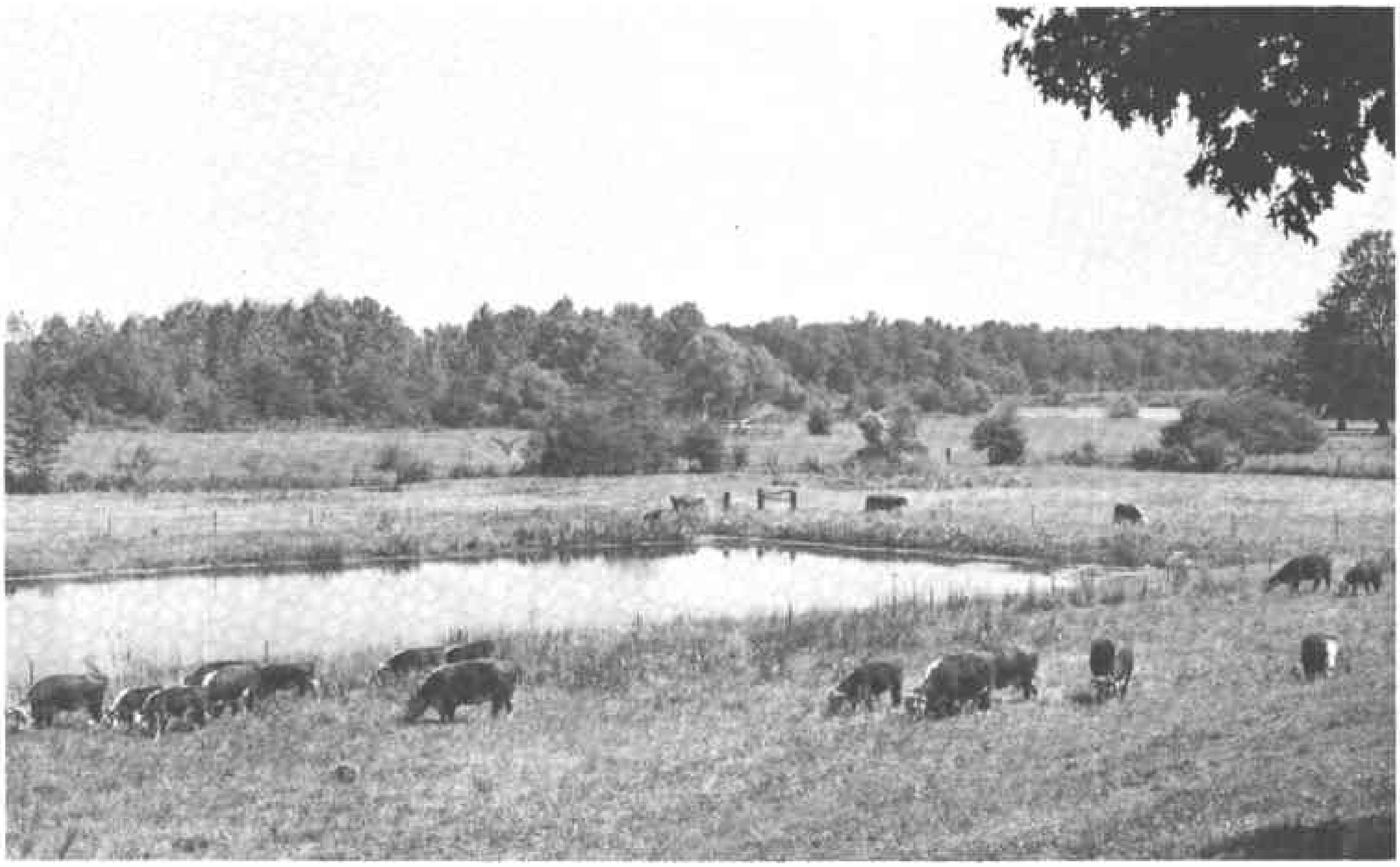
SOIL SURVEY OF

Hancock County, Indiana



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Purdue University Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1971-74. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1974. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished by the Hancock County Soil and Water Conservation District. Partial funding of this soil survey was provided by Hancock County through the budget of the Hancock County Commissioners and approved by the Hancock County Council.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, woodlands, and wildlife areas; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Hancock County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and gives the woodland group and the tree and shrub group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Wildlife managers and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about the soils in the section "Formation and Classification of the Soils."

Newcomers in the county may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: Dug-pit pond on Sloan silty clay loam. Water level is maintained by the high ground water table. The pond is fenced to protect it from livestock; area for watering stock is at the far corner of the pond.

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Issued May 1978

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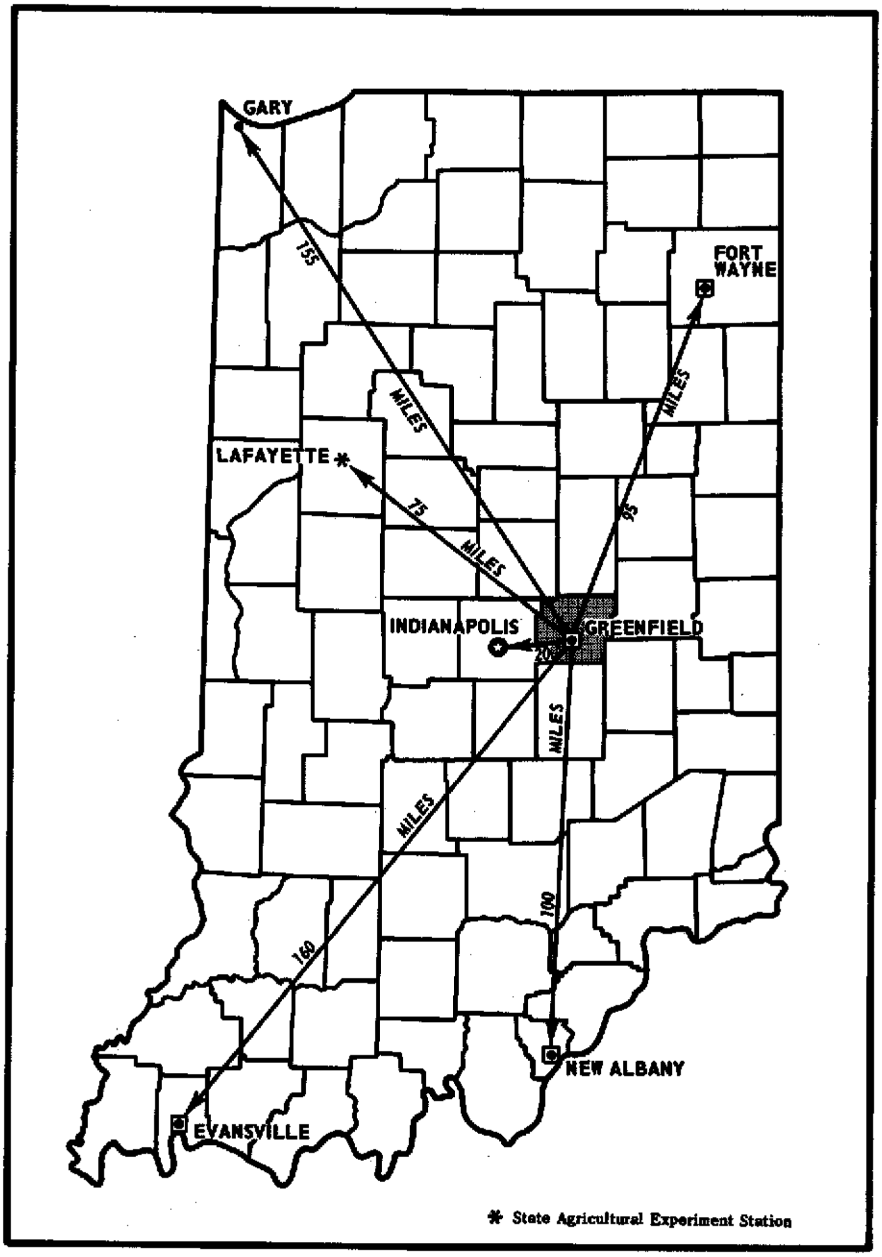

Location of Hancock County in Indiana.

SOIL SURVEY OF HANCOCK COUNTY, INDIANA

BY DONALD R. RUESCH, SOIL CONSERVATION SERVICE

FIELDWORK BY DONALD R. RUESCH, KELSO K. HUFFMAN, BOBBY L. PIRTLE, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

HANCOCK COUNTY is in the central part of Indiana (see map on facing page). It has an area of about 195,200 acres. Greenfield, the county seat, is the largest city.

Farming, mainly cash grain and livestock, is the leading occupation in Hancock County. Corn, soybeans, and wheat are the main cash-grain crops. Hogs, beef cattle, and some dairy cattle are the major kinds of livestock.

Hancock County does not have a lot of industry, although many people who live in the county are employed in industry. Most of them work in Indianapolis, Anderson, Muncie, or New Castle. The recent trend of moving out of the city and commuting to work has increased development of the rural areas of the county.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Hancock County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and nature of streams, the kinds of native plants or crops, the kinds of rock, if any, and many facts about the soil. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Brookston and Crosby, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Miami silt loam, 6 to 12 percent slopes, eroded, is one of several phases within the Miami series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Miami complex, 6 to 12 percent slopes, severely eroded, is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yield of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are predicted for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Hancock County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

Soil associations and delineations on the general soil map in this soil survey do not fully agree with those of the general soil maps in adjacent counties published at a different date. Differences in the maps are a result of improvements in the classification of soils, particularly in the modifications or refinements in soil series concepts. In addition, more precise and detailed maps are needed because the uses of the general soil maps have expanded in recent years. The more modern maps meet this need. Still another difference is caused by the range in slope that is permitted with associations in different surveys.

The soil associations in Hancock County are discussed in the following pages.

1. *Crosby-Brookston association*

Deep, somewhat poorly drained and very poorly drained, nearly level silt loams and silty clay loams that formed in glacial till or in loamy sediment and the underlying glacial till; on uplands

This association consists of nearly level broad uplands throughout the county. It covers about 142,000 acres, or about 72.7 percent of the county. It is 47 percent Crosby soils, 43 percent Brookston soils, and 10 percent soils of minor extent (fig. 1).

Crosby soils are on the slightly higher positions on the landscape. These soils are somewhat poorly drained and nearly level. Typically, the surface layer is dark grayish brown silt loam about 9 inches thick, and the subsurface layer is light gray silt loam about 3 inches thick. The upper 3 inches of the subsoil is mottled, yellowish brown, firm clay loam, and the lower 25 inches is mottled, grayish brown, firm clay loam. The underlying material to a depth of 60 inches is mottled, brown loam.

Brookston soils are in shallow depressions. These soils are very poorly drained and nearly level. Typically, the surface layer is very dark gray silty clay loam about 12 inches thick. The subsoil is mottled, gray, firm clay loam about 42 inches thick. The underlying material to a depth of 60 inches is mottled, yellowish brown loam.

Soils of minor extent are well drained Miami soils on rises and very poorly drained Kokomo and Milford soils in deep depressions.

Where adequately drained, the soils in this association are well suited to intensive row cropping. Wetness is the main limitation (fig. 2). Crops commonly grown are corn, soybeans, and small grain.

The soils of this association have severe limitations for septic tank absorption fields in residential developments because of a seasonal high water table and slow permeability.

2. *Miami-Crosby association*

Deep, well drained and somewhat poorly drained, nearly level to strongly sloping silt loams and clay loams that formed in glacial till; on uplands

This association consists of rolling uplands and breaks between the uplands and the bottom lands paralleling the major streams of the county. It covers about 33,000 acres, or about 16.9 percent of the county. It is 54 percent Miami soils, 36 percent Crosby soils, and 10 percent soils of minor extent (fig. 3).

Miami soils are on higher positions of uplands or on breaks between the uplands and the bottom lands. These soils are well drained and nearly level to strongly sloping. Typically, the surface layer is mainly brown heavy silt loam about 6 inches thick. In more steeply sloping, severely eroded areas, however, it is clay loam. The upper 9 inches of the subsoil is dark yellowish brown, firm clay loam, and the lower 18 inches is yellowish brown, firm clay loam. The underlying material to a depth of 60 inches is yellowish brown loam.

Crosby soils are on the lower positions on the landscape, on the foot slopes of larger slopes, and along small drainageways on the uplands. These soils are somewhat poorly drained and nearly level. Typically, the surface layer is dark grayish brown silt loam about 9 inches thick, and the subsurface layer is light gray

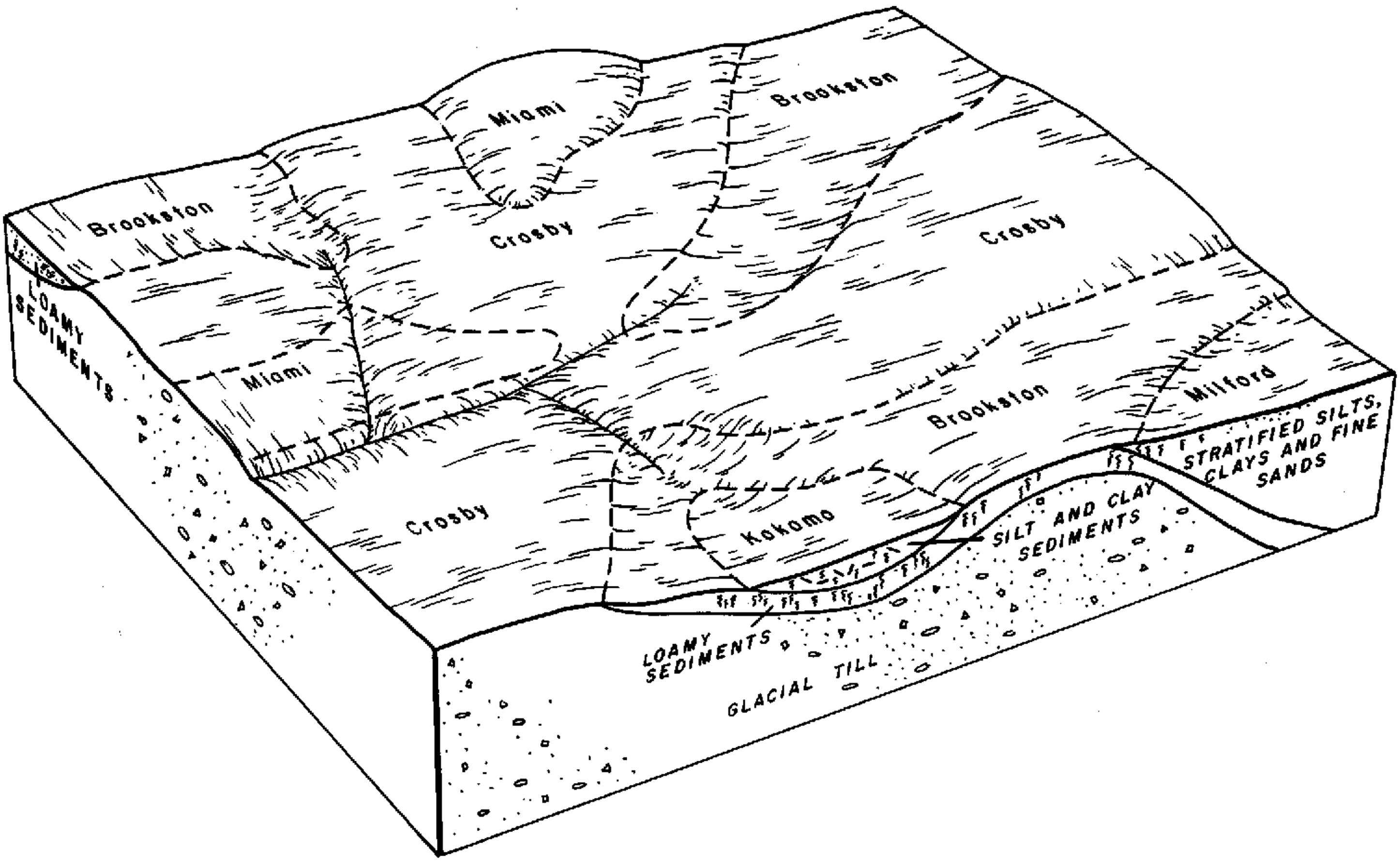

Figure 1.—**Pattern of soils and underlying material in the Crosby-Brookston association.**

silt loam about 3 inches thick. The upper 3 inches of the subsoil is yellowish brown, firm clay loam, and the lower 25 inches is mottled, grayish brown, firm clay loam. The underlying material to a depth of 60 inches is mottled, brown loam.

Soils of minor extent are very poorly drained Brookston soils in depressions and well drained Ockley soils on kames and narrow terraces along streams.

The soils in this association are suited to crops if they are managed properly. Erosion and wetness are the main limitations. Crop rotations that incorporate small grain and grass and legumes for forage are needed to help control erosion. Strongly sloping soils are used for hay or permanent pasture. Crops commonly grown are corn, soybeans, small grain, and grasses and legumes for forage. The association is well suited to livestock farming.

The soils of this association have moderate to severe limitations for septic tank absorption fields in residential developments because of moderately slow and slow permeability, a seasonal high water table, and slope.

3. *Ockley-Sloan-Shoals association*

Deep, well drained, somewhat poorly drained and very poorly drained, nearly level to moderately sloping silt loams and silty clay loams that formed in glacial outwash and alluvium; on terraces, outwash plains, and bottom lands

This association consists of nearly level to moderately sloping river terraces and outwash plains and nearly level bottom lands along streams throughout the county. It covers about 20,200 acres, or about 10.4 percent of the county. It is 25 percent Ockley soils, 17 percent Sloan soils, 16 percent Shoals soils, and 42 percent soils of minor extent (fig. 4).

Ockley soils are on the higher positions of terraces and outwash plains. These soils are well drained and nearly level to moderately sloping. Typically, the surface layer is brown silt loam about 8 inches thick, and the subsurface layer is dark yellowish brown silt loam 5 inches thick. The subsoil is about 36 inches thick. The upper 4 inches is dark yellowish brown, firm light clay loam; the next 4 inches is brown, firm, clay loam; the next 24 inches is brown, firm gravelly clay loam; and the lower 4 inches is dark yellowish brown, firm gravelly sandy clay loam. The underlying material to a depth of 60 inches is brown stratified sand and very gravelly sand.

Sloan soils are on low bottom lands of small streams. These soils are very poorly drained and nearly level. Typically, the surface layer is very dark gray and very dark grayish brown light silty clay loam about 13 inches thick. The subsoil is about 21 inches thick. The

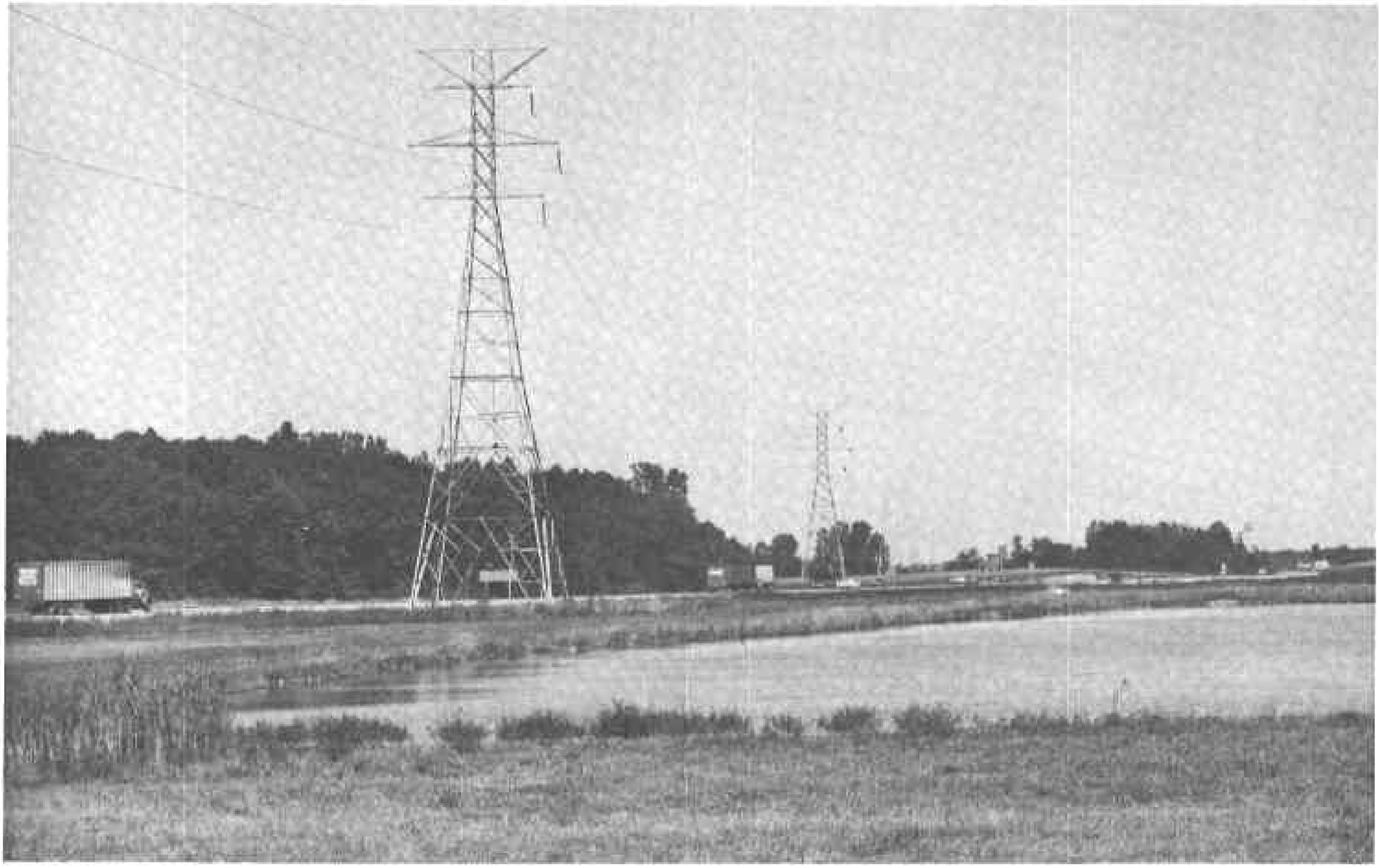

Figure 2.—Pond in Crosby and Brookston soils along interstate 70 formed when borrow pit filled with water. Water level is maintained by some runoff and by a seasonal high water table in these soils.

upper 7 inches is mottled, dark gray, firm light clay loam; the next 6 inches is mottled, gray firm clay loam; and the lower 8 inches is mottled, gray, friable heavy loam. The underlying material to a depth of 60 inches is dark grayish brown, stratified sandy loam, loam, and loamy very coarse sand.

Shoals soils are on the low bottom lands of streams. These soils are somewhat poorly drained and nearly level. Typically, the surface layer is dark grayish brown silt loam about 11 inches thick. The underlying material to a depth of 60 inches is 15 inches of mottled, grayish brown, stratified loam, silt loam, and clay loam; 9 inches of mottled, gray clay loam; and 25 inches of mottled, grayish brown, stratified loam, clay loam, silt loam, and sandy loam.

Soils of minor extent are very poorly drained Rensselaer and Westland soils in low depressions on terraces and outwash plains; somewhat poorly drained, nearly level Whitaker soils on outwash plains; and well drained Genesee soils and moderately well drained Eel soils on bottom lands of the larger streams in the county.

The soils in this association are well suited to intensive cropping. Erosion is a limitation on the gently sloping and moderately sloping Ockley soils, and in places these soils need practices to help control erosion; flooding and wetness are the main limitations on the other soils. Where adequately drained and protected from flooding, the soils in this association are commonly used for corn, soybeans, and small grain. Most small, narrow bottom lands are in pasture.

Ockley soils have slight limitations for residential development, but Sloan soils, Shoals soils, and the soils of minor extent have severe limitations because of flooding or a seasonal high water table.

Descriptions of the Soils

This section describes each soil series in detail and then, briefly, each mapping unit in that series. Unless stated otherwise, what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface down to rock or other underlying material. Each series contains two descriptions of the profile. The first is brief and in terms familiar to a layman. The second is more detailed and is included for those who need to make thorough and precise

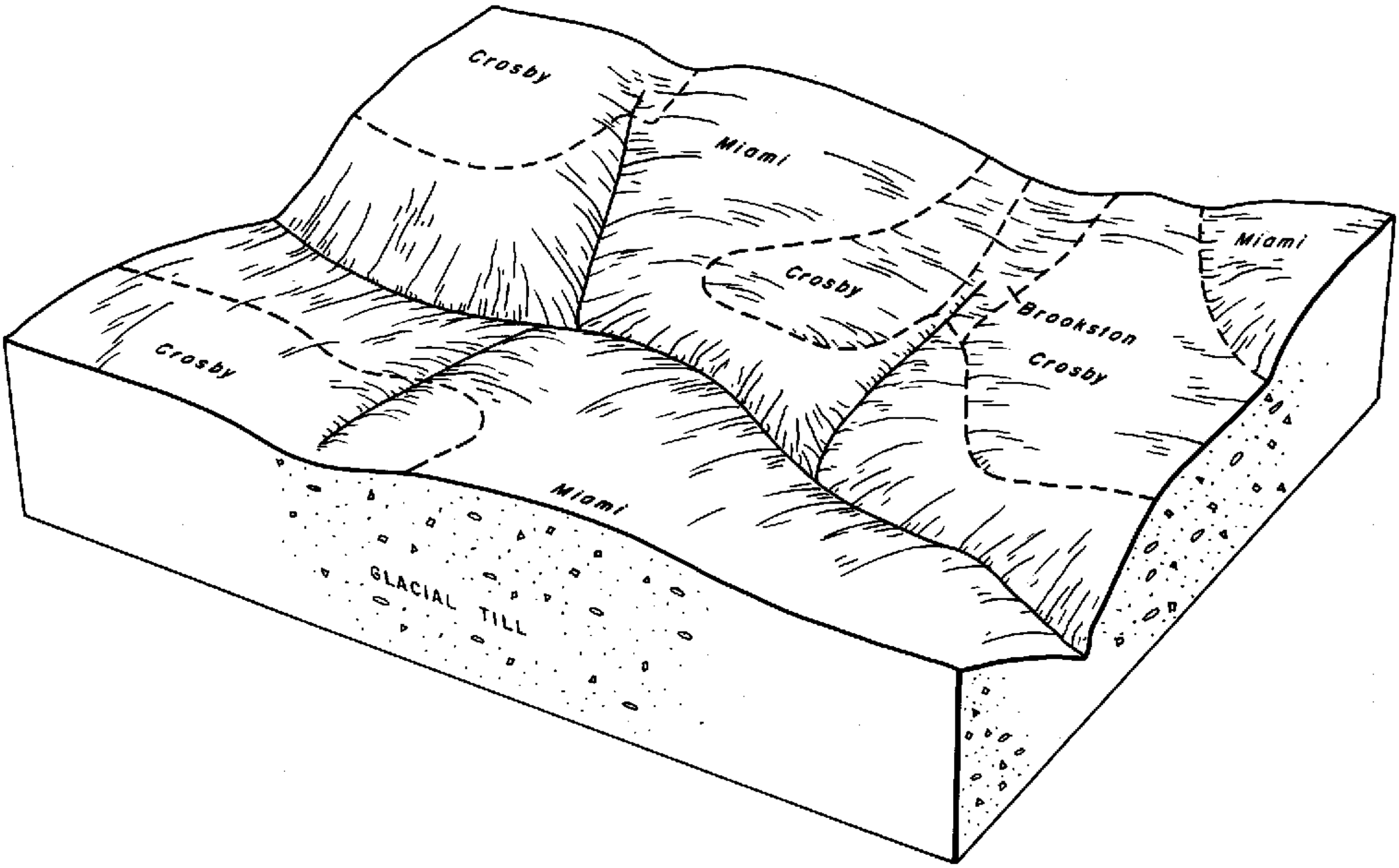

Figure 3.—Pattern of soils and underlying material in the Miami-Crosby association.

studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland group in which the mapping unit has been placed. The page where each capability unit is described and the woodland group in which each soil is placed is listed in the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*7*).[1]

Brookston Series

The Brookston series consists of deep, very poorly drained, nearly level soils. These soils are in slight depressions on uplands on the glacial till plain. They

[1] Italic numbers in parentheses refer to Literature Cited, p.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Brookston silty clay loam	64,500	33.0
Crosby silt loam, 0 to 3 percent slopes	78,200	40.1
Eel silt loam	2,300	1.2
Genesee silt loam	1,700	.9
Kokomo silty clay loam	2,200	1.1
Martinsville loam, 0 to 2 percent slopes	450	.2
Martinsville loam, 2 to 6 percent slopes, eroded	310	.2
Miami silt loam, 0 to 2 percent slopes	2,100	1.1
Miami silt loam, 2 to 6 percent slopes, eroded	17,600	9.0
Miami silt loam, 6 to 12 percent slopes, eroded	2,000	1.0
Miami silt loam, 12 to 18 percent slopes, eroded	1,400	.7
Miami complex, 6 to 12 percent slopes, severely eroded	3,300	1.7
Miami complex, 12 to 18 percent slopes, severely eroded	980	.5
Milford silty clay loam	940	.5
Ockley silt loam, 0 to 2 percent slopes	2,700	1.4
Ockley silt loam, 2 to 6 percent slopes, eroded	1,600	.8
Ockley complex, 6 to 12 percent slopes, eroded	560	.3
Palms muck	450	.2
Rensselaer silty clay loam	2,900	1.5
Shoals silt loam	3,300	1.7
Sloan silty clay loam	3,600	1.8
Westland clay loam	910	.5
Whitaker loam	580	.3
Gravel pits	160	.1
Water	460	.2
Total	195,200	100.0

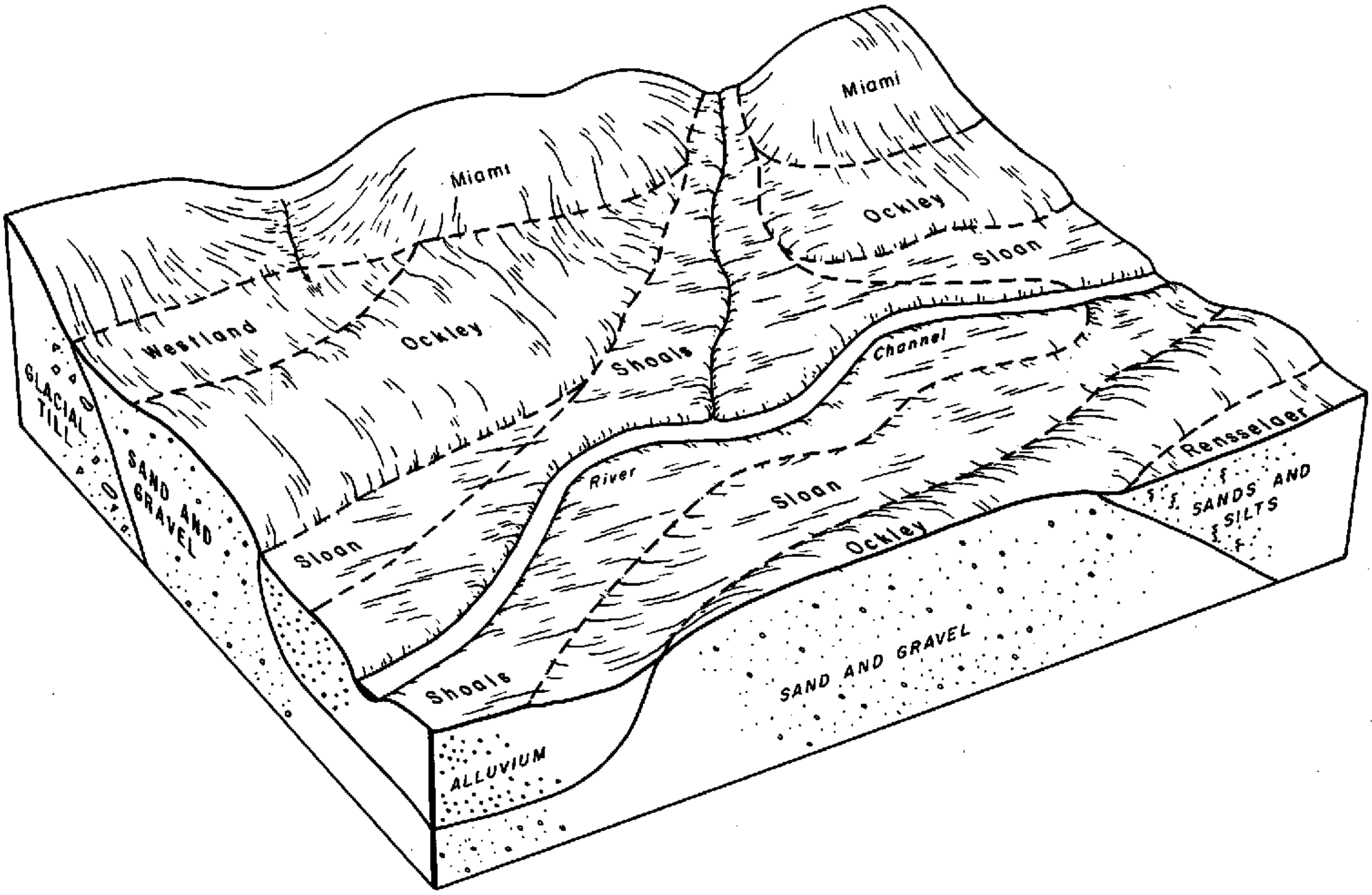

Figure 4.—**Pattern of soils and underlying material in the Ockley-Sloan-Shoals association.**

formed in loamy sediment and the underlying loamy glacial till. The native vegetation was water-tolerant hardwoods and marsh grasses.

In a representative profile the surface layer is very dark gray silty clay loam about 12 inches thick. The subsoil is gray, mottled, firm clay loam about 42 inches thick. The underlying material to a depth of 60 inches is yellowish brown, mottled, calcareous loam.

Available water capacity is high. Organic-matter content is high in the surface layer. Permeability is moderate in the surface layer and subsoil and moderately slow in the underlying material.

Brookston soils are well suited to farming where they are adequately drained. Because of wetness, these soils have severe limitations for most nonfarm uses.

Representative profile of Brookston silty clay loam, in a cultivated field, 920 feet west, 18 feet north of the southeast corner of NE¼ of sec. 24, T. 16 N., R. 5 E.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium granular structure; firm; few roots; slightly acid; abrupt smooth boundary.

A12—8 to 12 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium subangular blocky structure; firm; few roots; common discontinuous distinct thin black (10YR 2/1) organic films on faces of peds; slightly acid; clear smooth boundary.

B21tg—12 to 28 inches; gray (10YR 5/1) clay loam; many fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate coarse subangular blocky structure; firm; few roots; many discontinuous distinct medium dark gray (10YR 4/1) clay films on faces of peds; few small black (10YR 2/1) iron and manganese oxide concretions; few glacial pebbles; neutral; clear wavy boundary.

B22tg—28 to 42 inches; gray (5Y 5/1) clay loam; many medium distinct yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8) mottles; moderate coarse prismatic structure parting to strong medium and coarse subangular blocky; firm; few roots; common discontinuous distinct medium dark gray (10YR 4/1) clay films on faces of peds; few small black (10YR 2/1) iron and manganese oxide concretions; few glacial pebbles; neutral; clear wavy boundary.

B23tg—42 to 49 inches; gray (5Y 5/1) light clay loam; many medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; few roots; common patchy distinct thin dark gray (5Y 4/1) clay films on faces of peds; few glacial pebbles; neutral; clear wavy boundary.

B3g—49 to 54 inches; gray (10YR 5/1) light clay loam; many coarse distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few discontinuous distinct thin dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay films on faces of peds; few glacial pebbles; neutral; clear wavy boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; firm; few glacial pebbles; few vertical and horizontal cracks coated with grayish brown (10YR 5/2) lime accumulations; strong effervescence (30 percent calcium carbonate); moderately alkaline.

The solum is 42 to 60 inches thick. The A horizon is 11 to 16 inches thick. It is black (10YR 2/1), very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2) silty clay loam or clay loam. It is neutral or slightly acid.

The B horizon is gray (10YR 5/1, N 5/0, 5YY 5/1) dark gray (10YR 4/1 or N 4/0), or dark grayish brown (10YR 4/2). The B21 horizon is clay loam or silty clay loam. The B3 horizon is clay loam or loam. The B2 horizon is slightly acid or neutral, and the B3 horizon is neutral or mildly alkaline.

The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4) loam or light clay loam. It has gray or grayish brown mottles.

Brookston soils are near Crosby, Kokomo, Milford, and Rensselaer soils. They are similar in drainage to Kokomo, Milford, and Rensselaer soils. Brookston soils have less clay in the B21 horizon and B22 horizon than Kokomo and Milford soils. They lack the stratification in the lower part of the B horizon and in the C horizon that is present in Rensselaer soils. Brookston soils have a heavier textured, darker colored A horizon and a thicker solum than Crosby soils.

Br—Brookston silty clay loam (0 to 2 percent slopes). This nearly level soil is in depressions, swales, and narrow drainageways on uplands. Areas are irregular in shape and 2 to 400 acres in size. Because of continuous farming in some areas, the dark-colored surface layer is eroded and only 8 inches of it remains. Slope is dominantly less than 1 percent. Runoff is very slow or ponded (fig. 5).

Included in mapping in narrow drainageways are small areas of Brookston soils that have slopes of 3 to 4 percent and small areas of soils that have 8 to 16 inches of lighter colored silt loam or loam overwash from the adjoining soils. Undrained areas that stay wet most of the year or areas where water ponds for long periods are indicated by a special symbol on the soil map. Also included are small areas of Crosby soils on slight rises and Kokomo, Milford, and Rensselaer soils in deeper depressions.

Wetness is the main limitation. This soil becomes hard, cloddy, and difficult to farm if it is plowed when wet. Field tile and surface drains can be used to remove excess water. In the area southwest of Maxwell to southeast of Fortville, however, large rocks make tiling difficult. Where adequately drained, the soil is suited to corn, soybeans, and small grain. Most areas are farmed. Woodlots are small, and they mostly produce poor quality hardwoods. Capability unit IIw-1; woodland group 2w11.

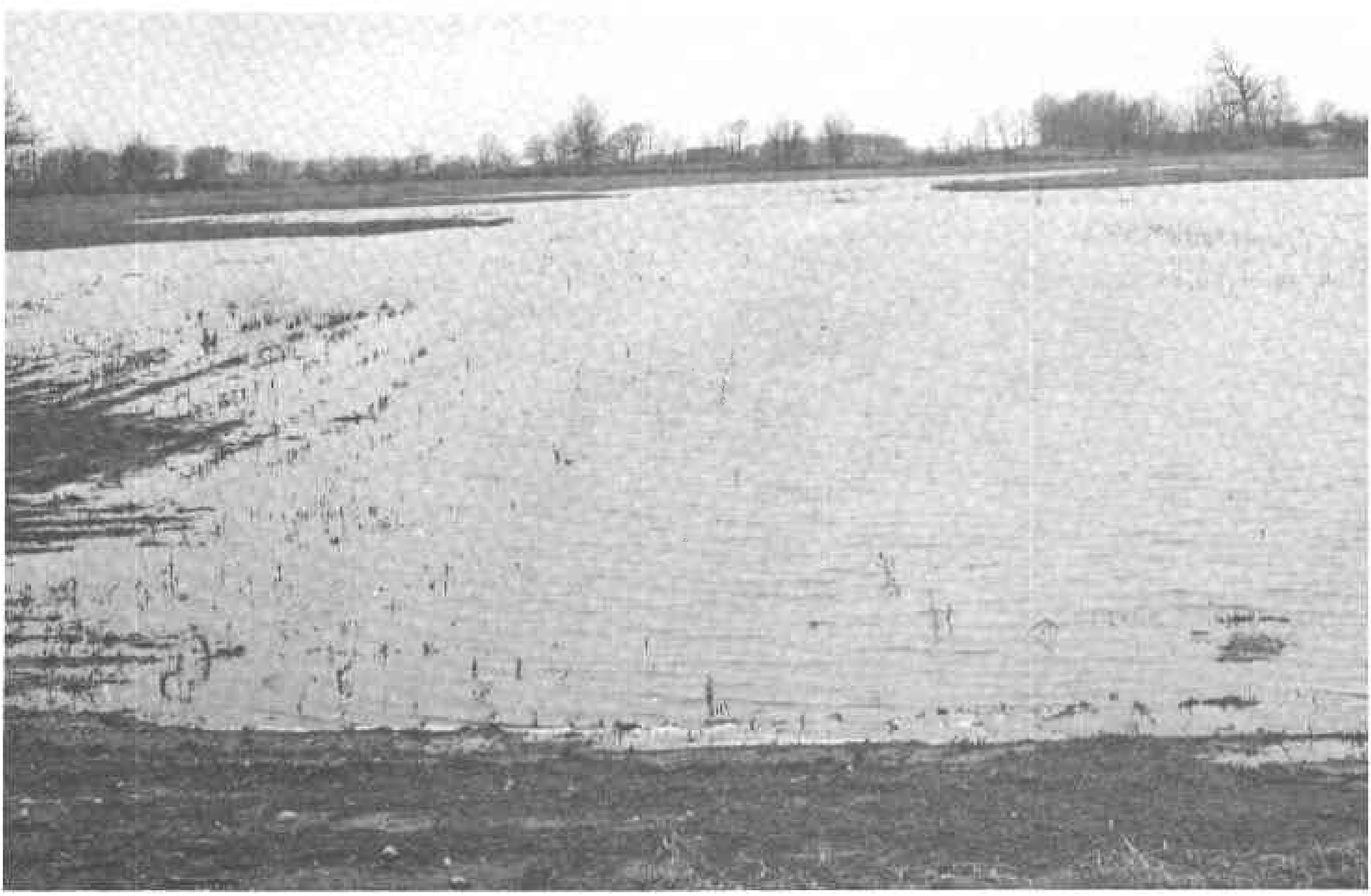

Figure 5.—Area of Brookston silty clay loam that is ponded after heavy rain early in spring.

Crosby Series

The Crosby series consists of deep, somewhat poorly drained, nearly level soils. These soils are on slightly higher areas on uplands on the glacial till plain. They formed in loamy glacial till. The native vegetation was water-tolerant hardwoods.

In a representative profile the surface layer is dark grayish brown silt loam about 9 inches thick, and the subsurface layer is gray, mottled silt loam about 3 inches thick. The subsoil is about 28 inches thick. The upper 3 inches is yellowish brown, mottled, firm clay loam, and the lower 25 inches is grayish brown, mottled, firm clay loam. The underlying material to a depth of 60 inches is mottled, brown loam.

Available water capacity is high. Organic-matter content in the surface layer is moderate. Permeability is slow.

Crosby soils are well suited to farming where they are adequately drained. Because of wetness and slow permeability, these soils have moderate to severe limitations for most nonfarm uses.

Representative profile of Crosby silt loam, 0 to 3 percent slopes, in a cultivated field, 330 feet west, 605 feet south of the northeast corner of SE¼ sec. 10, T. 15 N., R. 6 E.:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; few roots; slightly acid; abrupt smooth boundary.

A2—9 to 12 inches; gray (10YR 6/1) silt loam; many medium distinct yellowish brown (10YR 5/6, and 5/8) mottles; weak medium platy structure parting to moderate fine and medium granular; friable; few roots; common patchy distinct thin grayish brown 20YR 5/2) silt coatings on faces of peds; medium acid; abrupt wavy boundary.

B21t—12 to 15 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few roots; many continuous distinct thin grayish brown (10YR 5/2) clay films on faces of peds; many continuous distinct medium grayish brown (10YR 5/2) silt coatings on faces of peds; few fine hard black (10YR 2/1) iron and manganese oxide concretions; few glacial pebbles; medium acid; clear wavy boundary.

B22t—15 to 28 inches; grayish brown (10YR 5/2) heavy clay loam; many fine distinct yellowish brown (10YR 5/4) and pale brown (10YR 6/3) mottles; weak coarse prismatic structure parting to strong medium angular and subangular blocky; firm; few roots; many continuous distinct medium dark grayish brown (10YR 4/2) clay films on faces of peds; few fine hard black (10YR 2/1) iron and manganese oxide concretions; few glacial pebbles; slightly acid; clear wavy boundary.

B23t—28 to 36 inches; grayish brown (10YR 5/2) clay loam; many fine distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; firm; few roots; many discontinuous distinct medium dark grayish brown (10YR 4/2) clay films on faces of peds; few fine hard black (10YR 2/1) iron and manganese oxide concretions; few glacial pebbles; neutral; abrupt wavy boundary.

B3—36 to 40 inches; grayish brown (10YR 5/2) light clay loam; many coarse distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; few roots; many discontinuous distinct thin dark grayish brown (10YR 4/2) clay films on faces of peds; few glacial pebbles; slight effervescence (8 percent calcium carbonate); mildly alkaline; clear wavy boundary.

C—40 to 60 inches; brown (10YR 5/3) loam; common coarse distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; massive; very firm; few glacial pebbles; strong effervescence (35 percent calcium carbonate); moderately alkaline.

The solum is dominantly 30 to 40 inches thick but ranges from 26 to 42 inches in thickness. The A horizon is 8 to 14 inches thick. The Ap horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) silt loam or loam. The A2 horizon is mottled gray (10YR 5/1 or 6/1), grayish brown (10YR 5/2), or light brownish gray (10YR 6/2) silt loam or loam. The A2 horizon is absent where the Ap horizon is thick.

The B horizon is grayish brown (10YR 5/2 or 2.5Y 5/2), yellowish brown (10YR 5/4 or 5/6), or light grayish brown (10YR 6/2). Mottles are gray, brown, light brownish gray, or pale brown. The B21 horizon is clay loam or silty clay loam. The B3 horizon is light clay loam or loam. The B21 horizon and B22 horizon are slightly acid to strongly acid, and the B23 horizon and B3 horizon are slightly acid to mildly alkaline.

The C horizon is mottled brown (10YR 5/3) or yellowish brown (10YR 5/4 or 5/6) loam or heavy sandy loam.

Crosby soils are near Miami, Brookston, Kokomo, Milford, and Rensselaer soils. They are similar in drainage to Whitaker soils. Crosby soils have gray mottling in the upper 20 inches of the solum that is absent in Miami soils. They have a lighter colored and lighter textured A horizon than Brookston, Kokomo, Milford, and Rensselaer soils. Crosby soils lack the stratification in the lower part of the B horizon and in the C horizon that is present in Whitaker soils.

CrA—Crosby silt loam, 0 to 3 percent slopes. This nearly level soil is in slightly convex areas on uplands. Areas are irregular in shape and 2 to 250 acres in size. Slope is dominantly 1 to 3 percent. Runoff is slow.

Included with this soil in mapping near the headwaters of streams and on uplands adjacent to the streams, are areas of soils that formed in silty and loamy sediment and the underlying glacial till. The combined thickness of the surface layer and subsoil of these soils is 40 to 50 inches. Also included are areas that have common cobbles and large stones that are on or near the surface and that could damage farm machinery; small areas of Crosby soils along narrow drainageways and on foot slopes of gently sloping or sloping areas where slopes are more than 3 percent; and small areas of Brookston, Miami, and Whitaker soils. The Brookston soils are in small depressions. If they are not drained and stay wet most of the year, they are indicated on the soil map by a special symbol. The narrow breaks that have slopes of more than 6 percent are also indicated by a special symbol.

Wetness is the main limitation. Tile can be used to remove excess water. In the area southwest of Maxwell to southeast of Fortville, however, large rocks make tiling difficult. Where adequately drained, the soil is suited to corn, soybeans, and small grain. Most areas are farmed. Woodlots are small, and they mostly produce poor quality hardwoods. Capability unit IIw-2; woodland group 3w5.

Eel Series

The Eel series consists of deep, moderately well drained, nearly level soils. These soils are on bottom lands of streams. They formed in recent loamy alluvium. The native vegetation was hardwoods.

In a representative profile the surface layer is dark grayish brown silt loam about 12 inches thick. The underlying material, to a depth of 39 inches, is 4 inches of brown silt loam; 5 inches of mottled, brown silt loam; 10 inches of mottled, grayish brown loam; and 8 inches of mottled, grayish brown clay loam. Below this, to a depth of 60 inches, it is mottled, gray stratified sandy loam and sand.

Available water capacity is high. Organic-matter content in the surface layer is moderate. Permeability is moderate.

Eel soils are suited to farming. These soils are subject to occasional flooding during wet periods. Because of occasional flooding, the soils have severe limitations for most nonfarm uses.

Representative profile of Eel silt loam, in a cultivated field, 400 feet north, 430 feet east of the southwest corner of the SE¼ of sec. 8, T. 17 N., R. 8 E.:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; weak coarse granular structure; friable; common roots; many continuous faint thin very dark grayish brown (10YR 3/2) coatings on faces of peds; neutral; clear smooth boundary.

A12—6 to 12 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; few roots; many continuous faint thin very dark grayish brown (10YR 3/2) coatings on faces of peds; neutral; clear wavy boundary.

C1—12 to 16 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; few roots; many continuous distinct thin dark grayish brown (10YR 4/) coatings on faces of peds; neutral; clear wavy boundary.

C2—16 to 21 inches; brown (10YR 4/3) silt loam; few fine distinct dark brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few roots; many continuous distinct thin dark brown (10YR 3/3) coatings on faces of peds; neutral; abrupt wavy boundary.

C3—21 to 31 inches; grayish brown (10YR 5/2) loam; common fine distinct dark brown (7.5YR 4/4) and dark yellowish brown (10YR 4/4) mottles; massive; friable; few roots; neutral; clear wavy boundary.

C4—31 to 39 inches; grayish brown (10YR 5/2) light clay loam; common fine distinct dark brown (7.5YR 4/4) mottles; massive; firm; few roots; neutral; abrupt wavy boundary.

C5—39 to 60 inches; gray (10YR 5/1) stratified sandy loam and sand; many coarse distinct dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) mottles; massive and single grained; very friable and loose; slight effervescence (7 percent calcium carbonate); mildly alkaline.

The A horizon is 8 to 16 inches thick. It is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3) silt loam or loam and is neutral or slightly acid.

The C1 horizon is brown (10YR 5/3), yellowish brown (10YR 5/4), dark brown (10YR 4/3), or dark yellowish brown (10YR 4/4). Below the C1 horizon, the C horizon is mottled, dark brown (10YR 4/3), brown (10YR 5/3), grayish brown (10YR 5/2), or gray (10YR 5/1). Below a depth of about 40 inches, it is stratified loam, silt loam, sandy loam, loamy sand, and sand. It is neutral to moderately alkaline.

Eel soils are near Genesee, Shoals, and Sloan soils. They have mottling at a depth within 20 inches of the surface that is lacking in Genesee soils. Eel soils lack the dominantly gray color in the upper part of the C horizon that is present in Shoals soils. They have a lighter colored, lighter textured A horizon than Sloan soils, and they lack the dominantly gray color of those soils.

Ee—Eel silt loam (0 to 2 percent slopes). This nearly level soil is on bottom lands along streams in the county. It is in long, winding areas that range from 10 to 150 acres in size. Slope is dominantly less than 1 percent. Runoff is very slow.

Included with this soil in mapping are small areas of soils that are underlain by sand and gravel at a depth within 24 inches of the surface and small, natural levees next to the stream channels that are sandy loam or loamy sand and gravel. Areas that have been mined or are being mined for sand or gravel are indicated by a special symbol on the soil map. Also included are small areas of Genesee soils on about the same position on the landscape as the Eel soil, Shoals soils near uplands, and Sloan soils in small depressions and in old, narrow stream channels.

Flooding, generally in winter or early in spring, is the main limitation. The soil is suited to row crops but in some years replanting or late planting is necessary because of flooding. Crops planted in floodwater drainageways are subject to damage during high water from summer rain. Most areas on the larger bottom lands are farmed. The narrow bottom lands are dominantly in pasture or in woodland. Most woodlots produce high quality hardwoods if they are properly managed; otherwise, the quality of hardwoods is poor. Capability unit I-2; woodland group 1o8.

Genesee Series

The Genesee series consists of deep, well drained, nearly level soils. These soils are on bottom lands mainly along the larger streams. They formed in recent loamy alluvium. The native vegetation was hardwoods.

In a representative profile the surface layer is dark brown silt loam about 12 inches thick. The underlying material to a depth of 60 inches is 16 inches of brown silt loam; 10 inches of brown loam; 16 inches of dark yellowish brown loam; and 6 inches of mottled, yellowish brown stratified sandy loam and loamy sand.

Available water capacity is high. Organic-matter content in the surface layer is moderate. Permeability is moderate.

Genesee soils are well suited to farming. These soils are subject to occasional flooding during wet periods. Because of occasional flooding, the soils have severe limitations for most nonfarm uses.

Representative profile of Genesee silt loam, in a cultivated field, 560 feet south, 1,200 feet west of the northeast corner of the SE¼ of sec. 36, T. 15 N., R. 7 E.:

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam, brown (10YR 4/3) crushed; weak fine and medium granular structure; friable; few roots; slight effervescence (6 percent calcium carbonate); mildly alkaline; abrupt smooth boundary.

A12—9 to 12 inches; dark brown (10YR 3/3) silt loam, brown (10YR 4/3) crushed; weak fine and medium granular structure; friable; few roots; slight effervescence (6 percent calcium carbonate); mildly alkaline; abrupt smooth boundary.

C1—12 to 20 inches; brown (10YR 4/3) heavy silt loam;

weak fine subangular blocky structure; friable; few roots; common discontinuous distinct thin dark brown (10YR 3/3) coatings on faces of peds and in root channels; neutral; gradual smooth boundary.

C2—20 to 28 inches; brown (10YR 4/3) silt loam; massive; friable; few roots; neutral; clear smooth boundary.

C3—28 to 38 inches; brown (10YR 4/3) loam; massive; friable; few roots; neutral; clear smooth boundary.

C4—38 to 54 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; few snail shells; strong effervescence (25 percent calcium carbonate); moderately alkaline; clear smooth boundary.

C5—54 to 60 inches; yellowish brown (10YR 5/4) stratified sandy loam and loamy sand; few coarse distinct grayish brown (10YR 5/2) mottles; massive; very friable; strong effervescence (25 percent calcium carbonate); moderately alkaline.

The A horizon is 8 to 16 inches thick. It is dark grayish brown (10YR 4/2), brown (10YR 4/3), and dark brown (10YR 3/3). It is dominantly silt loam, but it ranges to loam and sandy loam. It is slightly acid to mildly alkaline.

The C horizon is brown (10YR 5/3 or 4/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4). Individual horizons are loam, silt loam, light silty clay loam, sandy loam that average more than 15 percent coarser than very fine sand. In places, dark grayish brown, dark gray, gray, or grayish brown mottles are in the C horizon below 30 inches. The C horizon is neutral to moderately alkaline.

Genesee soils are near Eel, Shoals, and Sloan soils. They have a lighter colored and lighter textured A horizon than Sloan soils. Genesee soils lack the gray mottling within 24 inches of the surface that is present in Eel, Shoals, and Sloan soils.

Ge—Genesee silt loam (0 to 2 percent slopes). This soil is on bottom lands along streams. Areas are long and winding in shape and 10 to 500 acres in size. Small areas on narrow bottom lands are underlain by sand and gravel within a depth of 30 inches of the surface. Some small areas along the smaller streams have a darker colored surface layer. Many areas along the larger streams have calcium carbonate throughout the profile. Slope is dominantly less than 1 percent. Runoff is very slow.

Included with this soil in mapping are small, natural levees next to the stream channels that have a loamy sand surface layer. Areas that have been mined or are being mined for sand or gravel are indicated on the soil map by a special symbol. Also included are small areas of Eel and Shoals soils, areas of Sloan soils in small depressions and in old, small, narrow stream channels, and small areas of Ockley and Martinsville soils on slight rises.

Flooding, mainly in winter and early in spring, is the main limitation. The soil is suited to row crops, but in some years replanting or late planting is necessary because of flooding. Crops planted in floodwater drainageways are subject to damage during high water from summer rain. Most large areas of bottom lands are farmed. The narrow bottom lands are dominantly in pasture or in woodland. Most woodlots produce high quality hardwoods if they are properly managed; otherwise, the quality of hardwoods is poor. Capability unit I-2; woodland group 1o8.

Kokomo Series

The Kokomo series consists of deep, very poorly drained, nearly level soils. These soils are in depressions on uplands on the glacial till plain. They formed in silty and clayey sediment and the underlying loamy glacial till. The native vegetation was water-tolerant hardwoods and marsh grasses.

In a representative profile the surface layer is very dark gray silty clay loam about 11 inches thick. The subsoil is about 33 inches thick. The upper 10 inches is mottled, dark gray, firm heavy silty clay loam; the next 8 inches is mottled, gray, firm heavy silty clay loam; the next 9 inches is mottled, light gray, firm silty clay loam; and the lower 6 inches is mottled, light gray, friable light clay loam. The underlying material to a depth of 60 inches is mottled, yellowish brown loam.

Available water capacity is high. Organic-matter content is high in the surface layer. Permeability is slow.

Kokomo soils are well suited to farming where they are adequately drained. Because of wetness and slow permeability, these soils have severe limitations for most nonfarm uses.

Representative profile of Kokomo silty clay loam, in a cultivated field, 1,160 feet south, 530 feet west of the northeast corner of NW¼ of sec. 14, T. 15 N., R. 6 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam; weak coarse granular structure; firm; few roots; neutral; abrupt smooth boundary.

A12—9 to 11 inches; very dark gray (10YR 3/1) silty clay loam; weak fine angular and subangular blocky structure; firm; few roots; neutral; clear wavy boundary.

B1g—11 to 14 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; firm; few roots; few patchy faint thin very dark gray (10YR 3/1) organic films on faces of peds and in voids; neutral; clear wavy boundary.

B21tg—14 to 21 inches; dark gray (10YR 4/1) heavy silty clay loam; many medium distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular and angular blocky structure; firm; few roots; few patchy faint thin dark gray (10YR 4/1) clay films on faces of peds; few continuous distinct thin very dark gray (10YR 3/1) organic films in voids and root channels; neutral; gradual wavy boundary.

B22tg—21 to 29 inches; gray (10YR 5/1) heavy silty clay loam; many fine and medium distinct brownish yellow (10YR 6/6) and light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate fine angular and subangular blocky; firm; few roots; common discontinuous distinct thin gray (10YR 5/1) clay films on faces of peds; common continuous distinct thin very dark gray (10YR 3/1) organic films on faces of peds; neutral; gradual wavy boundary.

B23tg—29 to 38 inches; light gray (10YR 6/1) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate coarse angular and subangular blocky; firm; few roots; common discontinuous distinct thin grayish brown (10YR 5/2) clay films on faces of peds; few continuous distinct thick very dark gray (10YR 3/1) organic accumulations in voids and root channels; neutral; clear wavy boundary.

IIB3g—38 to 44 inches; light gray (10YR 6/1) light clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few glacial pebbles; strong effervescence (15 percent calcium carbonate); moderately alkaline; clear wavy boundary.

IIC—44 to 60 inches; yellowish brown (10YR 5/4) loam; many medium and coarse distinct yellowish brown

(10YR 5/6), gray (10YR 5/1), and light gray (10YR 6/1) mottles; massive; firm; few glacial pebbles; strong effervescence (25 percent calcium carbonate); moderately alkaline.

The solum is 40 to 60 inches thick. The A1 horizon is 10 to 18 inches thick. It is black (10YR 2/1), very dark brown (10YR 2/2) or very dark gray (10YR 3/1) silty clay loam or clay loam. It is neutral or slightly acid.

The B horizon is dark gray (10YR 4/1, N 4/0, or 5Y 4/1), gray (10YR 5/1, N 5/0, or 5Y 5/1), and light gray (10YR 6/1). It has mottles of brownish yellow, yellowish brown, light olive brown, and olive brown. The B2 horizon is silty clay loam, clay loam, or silty clay. The B3 horizon is clay loam or loam. The B2 horizon is neutral to slightly acid, and the B3 horizon is neutral to moderately alkaline.

The C horizon is yellowish brown (10YR 5/4 or 5/6) or brown (10YR 5/3) loam or light clay loam. It has gray, light gray, or grayish brown mottles.

Kokomo soils are near Crosby, Brookston, Milford, and Rensselaer soils. They are similar in drainage to Brookston, Milford, and Rensselaer soils. Kokomo soils have a darker colored, heavier textured A horizon than Crosby soils. They have more clay in the upper part of the B2 horizon than Brookston and Rensselaer soils. Kokomo soils lack the stratification in the B3 horizon and C horizon that is present in Milford and Rensselaer soils.

Ko—Kokomo silty clay loam (0 to 2 percent slopes). This nearly level soil is in depressions on uplands. Areas are irregular in shape and 2 to 40 acres in size. Some areas of these soils are eroded and the dark-colored surface layer is as little as 8 inches thick. In some areas, the lower part of the subsoil is sandy loam. In other areas, the subsoil extends to a depth of more than 60 inches. Slope is dominantly less than 1 percent. Runoff is very slow or ponded.

Included with this soil in mapping are small areas of soils that have 8 to 16 inches of lighter colored silt loam overwash from the adjoining soils. Undrained areas that stay wet most of the year, areas where water ponds for long periods and areas that have small pockets of muck in the deeper depressions are indicated on the soil map by special symbols. Also included are small areas of Crosby soil on slight rises and Brookston, Rensselaer, and Milford soils in depressions.

Wetness is the main limitation. Ponding and a seasonal high water table damage crops (fig. 6). Tile, surface drains, and open ditches can be used to remove excess water. Adequate tile outlets are difficult to obtain in some of the deeper depressions. The soil becomes hard, cloddy, and difficult to farm if it is plowed when wet. Where adequately drained, the soil is well suited to corn, soybeans, and small grain. Most areas are farmed. Wooded areas are small, and they mostly produce poor quality hardwoods. Capability unit IIw-1; woodland group 2w11.

Martinsville Series

The Martinsville series consists of deep, well drained, nearly level and gently sloping soils. These soils are on the upper parts of river terraces and out-

Figure 6.—**Ponding after heavy rains drowned the soybeans in depressions in this area of Kokomo silty clay loam.**

wash plains. They formed in loamy and sandy glacial outwash. The native vegetation was hardwoods.

In a representative profile the surface layer is dark grayish brown loam about 8 inches thick, and the subsurface layer is yellowish brown loam about 5 inches thick. The subsoil is about 41 inches thick. The upper 12 inches is dark brown, friable clay loam; the next 7 inches is strong brown, friable sandy clay loam; the next 8 inches is brown and dark brown, friable sandy loam; the next 10 inches is dark brown, friable light sandy clay loam; and the lower 4 inches is brown, very friable loamy sand. The underlying material to a depth of 60 inches is brown and dark yellowish brown stratified fine sand, very fine sand, and silt loam.

Available water capacity is high. Organic-matter content is moderate in the surface layer. Permeability is moderate.

Martinsville soils are well suited to farming. These soils have slight limitations for most nonfarm uses.

Representative profile of Martinsville loam, 0 to 2 percent slopes, in a cultivated field, 125 feet south and 1,280 feet east of the northwest corner of SW¼ of sec. 24, T. 17 N., R. 6 E.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; moderate medium granular structure; friable; few roots; slightly acid; abrupt smooth boundary.

A2—8 to 13 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; few roots; strongly acid; clear wavy boundary.

B21t—13 to 25 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; friable; few roots; common continuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds; many continuous prominent medium brown (10YR 5/3) silt coatings on faces of peds; few glacial pebbles; medium acid; clear wavy boundary.

B22t—25 to 32 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium and coarse subangular blocky structure; friable; few roots common discontinuous distinct thin and medium dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

B23t—32 to 40 inches; brown (7.5YR 5/4) and dark brown (7.5YR 4/4) sandy loam; moderate medium and coarse subangular blocky structure; friable; few roots; few discontinuous distinct thin dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

B24t—40 to 50 inches; dark brown (7.5YR 4/4) light sandy clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; few patchy faint thin dark brown (10YR 3/3) clay films; slightly acid; clear wavy boundary.

B3—50 to 54 inches; brown (10YR 5/3) loamy sand; many coarse distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; very friable; neutral; abrupt smooth boundary.

C—54 to 60 inches; brown (10YR 5/3) and dark yellowish brown (10YR 4/4) stratified fine sand, very fine sand, and silt loam; single grained and massive; loose and very friable; few fine pebbles; violent effervescence (40 percent calcium carbonate); moderately alkaline.

The solum is 42 to 60 inches thick. The A horizon is 6 to 15 inches thick. It is slightly acid to strongly acid. The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 5/3) loam or silt loam. The A2 horizon is yellowish brown (10YR 5/4), brown (10YR 5/3), or grayish brown (10YR 5/2) loam or silt loam. The A2 horizon is lacking in eroded areas.

The B horizon is brown (10YR 5/3 or 7.5YR 5/4) yellowish brown (10YR 5/4 or 5/6), strong brown (7.5YR 5/6), or dark brown (7.5YR 4/4 or 10YR 4/3). The B21 horizon is clay loam or silty clay loam. The B22, and B24 horizons are clay loam, sandy clay loam, or sandy loam. The B3 horizon is sandy clay loam, sandy loam, or loamy sand. The B2 horizon is slightly acid to strongly acid. The B3 horizon is slightly acid to mildly alkaline.

The C horizon is brown (10YR 5/3), yellowish brown (10YR 5/4) or dark yellowish brown (10YR 4/4) stratified loam, silt loam, sandy loam, loamy sand, and sand. In some profiles, the C horizon has gray or grayish brown mottles.

Martinsville soils are near Whitaker, Rensselaer, Westland, and Ockley soils. They are similar in drainage to Ockley and Miami soils. Martinsville soils lack the gray mottling in the upper part of the B horizon that is present in Whitaker, Rensselaer, and Westland soils. They have a lighter colored and lighter textured A horizon than Rensselaer and Westland soils. Martinsville soils lack the gravel in the lower part of the B horizon and in the C horizon that is present in Ockley soils. They have a deeper solum and have more stratification in the lower part of the B horizon and in the C horizon than Miami soils.

MaA—Martinsville loam, 0 to 2 percent slopes. This nearly level soil is on outwash plains and river terraces. Areas are irregular in shape and 2 to 25 acres in size. This soil has the profile described as representative of the series. Slope is dominantly 1 to 2 percent. Runoff is slow.

Included with this soil in mapping are small areas of Martinsville soils on rises and narrow breaks that have slopes of 2 to 6 percent, some areas that have a thin layer of gravelly clay loam or a few glacial pebbles in the subsoil, and some areas where the subsoil extends to a depth of more than 60 inches. Small, narrow areas that have slopes of more than 6 percent are indicated on the soil map by a special symbol. Also included are small areas of Ockley, Whitaker, and Rensselaer soils. The Ockley soils are on small rises and narrow breaks, and where severely eroded, they are indicated on the soil map by a severe erosion symbol. The Whitaker and Rensselaer soils are in low, flat, or depressional areas.

This Martinsville soil is suited to intensive row cropping. Most areas are farmed. Woodlots are small. Capability unit I-1; woodland group 1o1.

MaB2—Martinsville loam, 2 to 6 percent slopes, eroded. This gently sloping soil is on gently rolling outwash plains and river terraces. Areas are oval or narrow and winding in shape and 2 to 10 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is thinner and the subsurface layer is no longer present because of plowing and the loss of soil material through erosion. Slope is dominantly 2 to 4 percent. Runoff is medium.

Included with this soil in mapping are small areas of Martinsville soils, on the tops of rises, that have slopes of 0 to 2 percent and areas, along breaks and narrow drainageways, that have slopes of more than 6 percent. There are also areas where the slope is more than 12 percent and small, severely eroded areas that have a clay loam surface layer; these areas are indicated by special symbols on the soil map. Also included are some areas of this Martinsville soil where a thin layer of gravelly clay loam or a few glacial pebbles are in the subsoil, some areas where the subsoil extends to a depth of more than 60 inches, and small areas of Ockley soils on small rises and narrow breaks.

This Martinsville soil is suited to cropping. Most areas are farmed. Erosion is the major hazard if this soil is farmed. Woodlots are small. Capability unit IIe-1; woodland group 1o1.

Miami Series

The Miami series consists of deep, well drained, nearly level to strongly sloping soils. These soils are in rolling areas and breaks on uplands on the glacial till plain. They formed in loamy glacial till. The native vegetation was hardwoods.

In a representative profile the surface layer is brown heavy silt loam about 6 inches thick. The subsoil is about 27 inches thick. The upper 9 inches is dark yellowish brown, firm clay loam, and the lower 18 inches is yellowish brown, firm clay loam. The underlying material to a depth of 60 inches is yellowish brown loam (fig. 7).

Available water capacity is high. Organic-matter content is moderate in the surface layer. Permeability is moderate in the surface layer and subsoil and moderately slow in the underlying material.

Miami soils are suited to farming if they are properly managed. Because the range of slopes is wide, these soils have slight to severe limitations for most nonfarm uses.

Representative profile of Miami silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 575 feet south, 355 feet west of the northeast corner of sec. 29, T. 16 N., R. 7 E.:

Ap—0 to 6 inches; brown (10YR 4/3) heavy silt loam; moderate medium granular structure; friable; common roots; few glacial pebbles; slightly acid; abrupt smooth boundary.

B21t—6 to 15 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few roots; common discontinuous distinct thin dark brown (7.5YR 4/2) clay films on faces of peds; common discontinuous distinct thin dark yellowish brown (10YR 3/4) silt coatings on vertical faces of peds; few glacial pebbles; medium acid; clear wavy boundary.

B22t—15 to 23 inches; yellowish brown (10YR 5/4) clay loam; moderate coarse subangular blocky structure; firm; few roots; common discontinuous distinct thin dark brown (7.5YR 4/2) clay films on faces of peds and in root channels; few glacial pebbles; strongly acid; clear wavy boundary.

B23t—23 to 28 inches; yellowish brown (10YR 5/4) clay loam; moderate coarse subangular blocky structure; firm; few roots; common discontinuous prominent medium and thick dark brown (10YR 3/3) clay films on faces of peds, in root channels, and in voids; few glacial pebbles; strongly acid; clear wavy boundary.

B3—28 to 33 inches; yellowish brown (10YR 5/4) light clay loam; weak very coarse subangular blocky structure; firm; few roots; few patchy distinct thin dark brown (10YR 3/3) clay films on faces of peds; few glacial pebbles; slight effervescence (12 percent calcium carbonate); mildly alkaline; abrupt wavy boundary.

C—33 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; few glacial pebbles; strong effervescence (25 percent calcium carbonate); moderately alkaline.

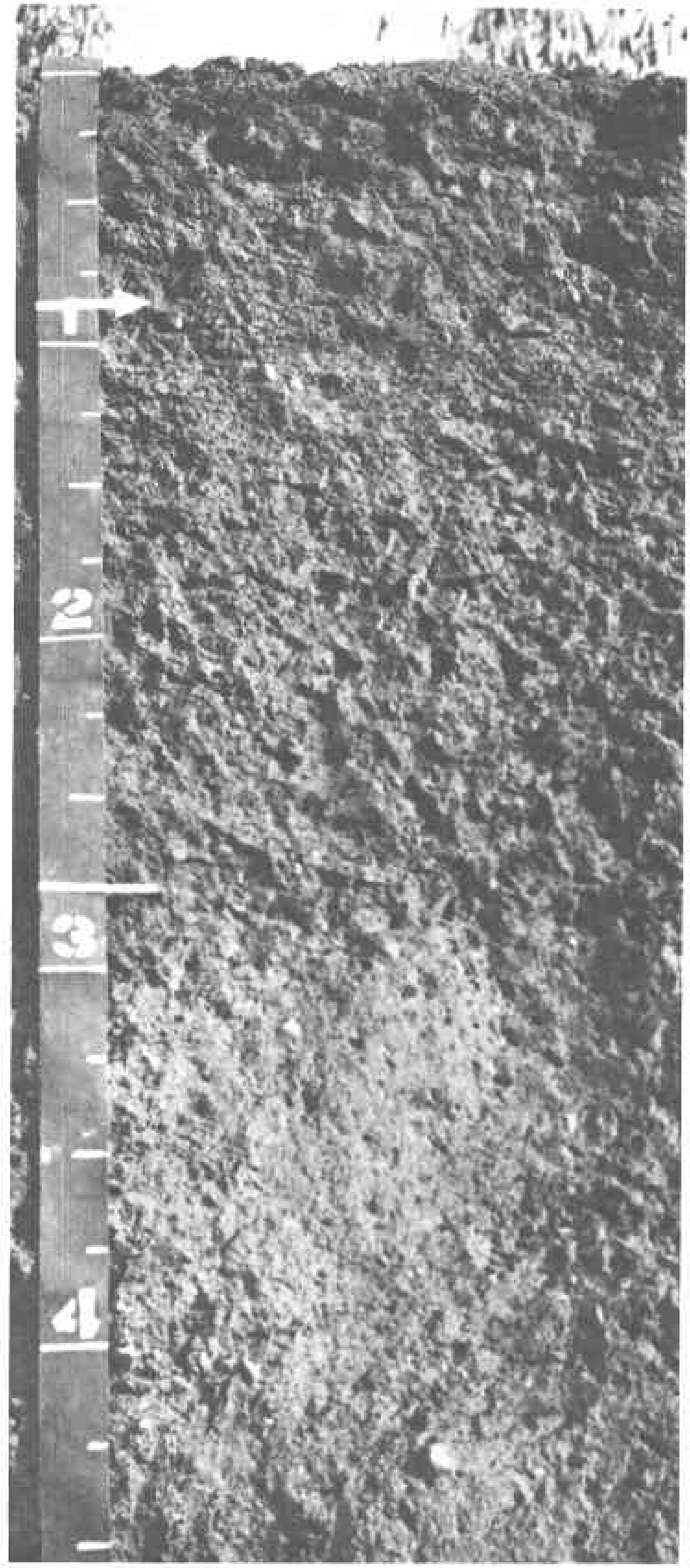

Figure 7.—**Profile of Miami silt loam, 0 to 2 percent slopes. Arrow points to boundary between the silt loam surface layer and the clay loam subsoil. White line indicates boundary between clay loam subsoil and underlying dense loam glacial till.**

The solum is 24 to 38 inches thick. The A horizon is 6 to 12 inches thick. It is neutral to medium acid. The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3 or 7.5YR 4/4), or dark yellowish brown (10YR 4/4) silt loam or loam. In undisturbed areas the A1 horizon is very dark gray, (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2). In uneroded or slightly eroded areas the A2 horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3), or yellowish brown (10YR 5/4) silt loam or loam.

The B horizon is brown (10YR 5/3 or 4/3, or 7.5YR 4/4), yellowish brown (10YR 5/4 or 5/6), dark yellowish brown (10YR 4/4), or strong brown, (7.5YR 5/6). The B2 horizon is clay loam or silty clay loam. It is slightly acid to strongly acid. The B3 horizon is light clay loam or loam. In places it has dark grayish brown or grayish brown mottles. It is slightly acid to mildly alkaline.

The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4) loam or sandy loam, and in places it has gray or grayish brown mottles.

Miami soils are near Crosby, Brookston, and Ockley soils. They are similar in drainage to Ockley and Martinsville soils. Miami soils lack the gray mottling in the upper part of the B horizon that is present in Crosby and Brookston soils. They have a lighter colored A horizon than Brookston soils. Miami soils lack the stratification in the lower part of the B horizon and in the C horizon that is present in Ockley and Martinsville soils.

MmA—Miami silt loam, 0 to 2 percent slopes. This nearly level soil is on uplands adjacent to streams or old glacial riverbeds. Areas are irregular in shape and 2 to 80 acres in size. The soil has a profile similar to the one described as representative of the series, but the surface layer is thicker and in most places there is a subsurface layer. This soil is underlain in some areas by a layer of sand or gravel at a depth of 6 to 12 feet. Slope is dominantly 1 to 2 percent. Runoff is slow.

Included with this soil in mapping are areas of soils that have thin layers of loamy, sandy, or gravelly outwash material in the upper part of the subsoil. In these areas the combined thickness of the surface layer and subsoil is 40 to 56 inches. Areas that have common cobbles and large stones that are on or near the surface and that could damage farm machinery and areas of Miami soils that have slopes of 2 to 6 percent are included. There are also small, sloping, severely eroded areas, small, narrow breaks where slopes are more than 6 percent, and small depressions that stay wet most of the year; these areas are indicated by special symbols on the soil map. Also included are small areas of Crosby soils in slight depressions and Martinsville soils in areas next to outwash soils.

This Miami soil is well suited to intensive cropping if properly managed. Most areas are farmed. Woodlots are small. Capability unit I-1; woodland group 1o1.

MmB2—Miami silt loam, 2 to 6 percent slopes, eroded. This gently sloping soil is on uplands. Areas are oval or irregular in shape and 2 to 30 acres in size. The soil has the profile described as representative of the series. Slope is dominantly 3 to 6 percent. Runoff is medium.

Included with this soil in mapping are small areas of Miami soils that have thin layers of loamy, sandy, or gravelly outwash material in the upper part of the subsoil. In these areas the combined thickness of the surface layer and subsoil is 36 to 50 inches. Small areas of Miami soils that have slopes of 0 to 2 percent or 6 to 12 percent and areas that have common cobbles and large stones that are on or near the surface and that could damage farm machinery are included. Also included are a few areas in permanent pasture or woodland that are uneroded or slightly eroded, small areas of Crosby soils in small drainageways and on foot slopes, and small areas of Ockley soils on the tops of some rises. There are also small areas of Ockley soils where the gravel has been mined; small, narrow areas where slopes are more than 12 percent; small, severely eroded areas; and small, depressional areas that stay wet most of the year. These areas are indicated by special symbols on the soil map.

This Miami soil is suited to farming if it is properly managed, and most areas are farmed. Erosion is the main hazard if this soil is farmed. Most woodlots are small, but they produce good quality hardwoods if they are properly managed. Capability unit IIe-1; woodland group 1o1.

MmC2—Miami silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is on uplands and along breaks between the uplands and the bottom lands. Areas are oval or irregular in shape and 2 to 30 acres in size. The soil has a profile similar to the one described as representative of the series, but the combined thickness of the surface layer and subsoil is dominantly less than 30 inches and in some small areas it is less than 24 inches. Runoff is medium to rapid.

Included with this soil in mapping are small areas of soils that have slopes of less than 6 percent or more than 12 percent; areas that have common cobbles and large stones that are on or near the surface and that could damage farm machinery; and uneroded or slightly eroded areas that have been left in permanent pasture or woodland. Also included are small areas of Crosby soils in small drainageways and on foot slopes and Ockley soils on the tops of some knolls. There are also small areas of Ockley soils where the gravel has been mined; small, narrow areas where slopes are more than 18 percent; and small, severely eroded areas. These areas are indicated by special symbols on the soil map.

This Miami soil is suited to farming if it is properly managed. Erosion is the main hazard to farming. Most areas are farmed, and most larger areas are used for grasses and legumes for forage. Most woodlots are small, but they produce good quality hardwoods if they are properly managed. Capability unit IIIe-1; woodland group 1o1.

MmD2—Miami silt loam, 12 to 18 percent slopes, eroded. This soil is along breaks between the uplands and the bottom lands. Areas are long, narrow, and winding in shape and 2 to 40 acres in size. The soil has a profile similar to the one described as representative of the series, but the combined thickness of the surface layer and subsoil is dominantly less than 26 inches. Runoff is rapid.

Included with this soil in mapping are small areas of soils that have slopes of less than 12 percent or more than 18 percent; areas that have very common cobbles and large stones that are on or near the surface and that could damage farm machinery; and small areas in permanent pasture or woodland that are uneroded or slightly eroded. Also included are small areas of Ockley soils. There are also areas of Ockley soils where the gravel has been mined, areas where slopes are more than 25 percent, and small, severely eroded areas; these areas are indicated by special symbols on the soil map.

This Miami soil is suited to occasional planting of row crops if it is properly managed. Most areas are in woodlots or pasture. Most woodlots are long and narrow, and they produce good quality hardwoods if they are properly managed. Capability unit IVe-1; woodland group 1o1.

MpC3—Miami complex, 6 to 12 percent slopes, severely eroded. These moderately sloping soils are on uplands and along breaks between the uplands and the bottom lands. Areas are oval or long or irregular in shape and 2 to 15 acres in size. The Miami soil in this complex has a profile similar to the one described as representative of the series, but the surface layer is clay loam and depth to the underlying material is less. Also in this complex are similar soils that have underlying material at a depth of 14 to 22 inches; deep, well drained soils, at the crest of slopes, where the subsoil is eroded away and the alkaline underlying material is at or near the surface; and small areas of a soil, near the base of slopes, that has a thick surface layer because of the deposition of soil that has eroded from the upper part of the slopes.

Included with these soils in mapping are small areas of eroded and severely eroded Miami soils that have slopes of less than 6 percent or more than 12 percent. Also included are small areas of Crosby soils along small drainageways and small areas of Ockley soils on the tops of some knolls. There are also areas of Ockley soils where gravel has been mined and small, narrow areas where slopes are more than 18 percent; these areas are indicated by special symbols on the soil map.

The soils in this complex are suited to an occasional planting of row crops if they are properly managed. Cropping systems that include small grain and grasses and legumes for forage are needed to help prevent erosion. Some areas that were formerly cultivated are reverting to pasture or woodland, and in these areas woodlots are young. Woodlots produce high-quality hardwoods if they are properly managed. Capability unit IVe-1; woodland group 1o1.

MpD3—Miami complex, 12 to 18 percent slopes, severely eroded. These soils are along breaks between the uplands and the bottom lands. Areas are long and narrow or irregular in shape and 1 acre to 10 acres in size. The Miami soil in this complex has a profile similar to the one described as representative of the series, but the surface layer is clay loam and the depth to the underlying material is less. Also in this complex are similar soils where the underlying material is at a depth of 14 to 22 inches; areas of soils, near the crest of the slopes, where the subsoil is eroded away and the alkaline underlying material is at or near the surface; and soils, near foot slopes and along waterways, that have a thick, silt loam surface layer because of the deposition of soil eroded from the upper part of the slopes. Cobbles and large stones are at or near the surface and hinder fieldwork in some places.

Included with these soils in mapping are small areas of soils that have slopes of less than 12 percent or more than 18 percent. Also included are areas of Crosby soils in drainageways and Ockley soils where the gravel has been mined and small, narrow areas where slopes are more than 25 percent; these areas are indicated by special symbols on the soil map.

The soils in this complex are suited to permanent vegetation. Most areas are in pasture or woodland. The trees in most woodlots are young because the areas were formerly farmed. These woodlots can produce good quality hardwood trees if they are properly managed. Capability unit VIe-1; woodland group 1o1.

Milford Series

The Milford series consists of deep, very poorly drained, nearly level soils. These soils are in deep depressions on the uplands. These depressions were marshes and shallow lakes on the glacial till plain. The soils formed in stratified silty and clayey sediment. The native vegetation was marsh grasses and a few water-tolerant trees.

In a representative profile the surface layer is black silty clay loam about 9 inches thick. The subsoil is about 31 inches thick. The upper 12 inches is mottled, dark gray, firm silty clay; the next 15 inches is mottled, olive gray, firm heavy silty clay loam; and the lower 4 inches is mottled, gray, firm silty clay loam. The underlying material to a depth of 60 inches is mottled, grayish brown and yellowish brown stratified silty clay loam and silt loam.

Available water capacity is high. Organic-matter content is high in the surface layer. Permeability is moderately slow.

Milford soils are well suited to intensive farming where they are adequately drained. Because of wetness and moderately slow permeability, these soils have severe limitations for most nonfarm uses.

Representative profile of Milford silty clay loam, in a cultivated field, 580 feet south and 640 feet east of the northwest corner of sec. 29, T. 17 N., R. 8 E.:

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam; moderate fine and very fine subangular blocky structure; firm; few roots; neutral; abrupt smooth boundary.

B21g—9 to 12 inches; very dark gray (10YR 3/1) silty clay; few fine distinct dark brown (10YR 3/3) mottles; moderate fine and medium subangular blocky structure; firm; few roots; common patchy distinct thin black (10YR 2/1) organic films on faces of peds and in root channels; neutral; clear wavy boundary.

B22g—12 to 21 inches; dark gray (10YR 4/1) silty clay; common medium distinct gray (10YR 5/1), brown (10YR 5/3), and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few roots; neutral; clear wavy boundary.

B23g—21 to 36 inches; olive gray (5Y 5/2) heavy silty clay loam; common medium distinct gray (10YR

5/1), brown (10YR 5/3), and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few roots; few patchy distinct thin very dark gray (10YR 3/1) organic films on faces of peds and in root channels; neutral; clear wavy boundary.

B3g—36 to 40 inches; gray (5Y 5/1) silty clay loam; many fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse subangular blocky structure; firm; few roots; slight effervescence (17 percent calcium carbonate); mildly alkaline; clear wavy boundary.

C1g—40 to 45 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles, massive; few roots; few patchy distinct thin gray (5Y 5/1) coatings on root channels; strong effervescence (25 percent calcium carbonate); moderately alkaline; clear smooth boundary.

C2—45 to 60 inches; yellowish brown (10YR 5/6) silt loam; many fine distinct gray (10YR 5/1) mottles; massive; firm; strong effervescence (25 percent calcium carbonate); moderately alkaline.

The solum is commonly 36 to 48 inches thick. The A horizon is 8 to 14 inches thick. It is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1) silty clay loam. It is neutral or slightly acid.

The B horizon is very dark gray (10YR 3/1 or N 3/0), dark gray (10YR 4/1, N 4/0, or 5Y 4/1), gray (10YR 5/1, 5Y 5/1, or N 5/0), grayish brown (10YR 5/2 or 2.5Y 5/2), or olive gray (5Y 5/2 or 4/2). The B21 horizon and B22 horizon are silty clay loam or silty clay, and the B23 horizon and B3 horizon are silty clay loam or silt loam. Mottles in the B horizon are yellowish brown, brown, dark brown, or dark yellowish brown. The B2 horizon is neutral to slightly acid, and the B3 horizon is neutral to moderately alkaline.

The C horizon is mottled, gray (10YR 5/1 or 5Y 5/1), grayish brown (10YR 5/2 or 2.5YR 5/2), or yellowish brown (10YR 5/4 or 5/6). It is predominantly stratified silt loam and silty clay loam, but in many places it contains layers ranging from silty clay to fine sandy loam.

Milford soils are near Kokomo, Brookston, Rensselaer, and Crosby soils. They are similar in drainage to Kokomo, Brookston, and Rensselaer soils. Milford soils have more stratification in the lower part of the B horizon and in the C horizon than Kokomo and Brookston soils. They contain more clay and less sand in the B horizon than Brookston and Rensselaer soils. Milford soils have a fine textured, darker colored A horizon than Crosby soils.

Mr—Milford silty clay loam (0 to 2 percent slopes). This nearly level soil is in depressions on uplands. Areas are oval in shape and 7 to 60 acres in size. In many small areas the combined thickness of the surface layer and subsoil ranges from 16 to 36 inches. The clay content decreases sharply below a depth of 24 inches in these areas. A few areas have layers of stratified sand in the underlying material between depths of 40 and 60 inches. Slope is dominantly less than 1 percent. Runoff is very slow or ponded.

Included with this soil in mapping are small areas of soils that have 8 to 16 inches of lighter colored silt loam overwash from the adjoining soils. There are undrained areas that stay wet most of the year, areas where water ponds for long periods, and small wet areas covered with a layer of muck; these areas are indicated by special symbols on the soil map. Also included are small areas of Brookston, Kokomo, and Rensselaer soils on slightly higher depressional areas.

Wetness and ponding are the main limitations. The soil becomes hard, cloddy, and difficult to farm if it is plowed when wet. Field tile, surface drains, and open ditches can be used to remove excess water. Where adequately drained, the soil is suited to intensive farming. Most areas are farmed. Wooded areas are small, and they mostly produce poor stands of hardwoods. Capability unit IIw-1; woodland group 2w11.

Ockley Series

The Ockley series consists of deep, well drained, nearly level to moderately sloping soils. These soils are on outwash plains and river terraces. They formed in loamy outwash and gravelly glacial outwash. The native vegetation was hardwoods.

In a representative profile the surface layer is brown silt loam about 8 inches thick. The subsurface layer is dark yellowish brown silt loam about 5 inches thick. The subsoil is about 36 inches thick. The upper 4 inches is dark yellowish brown, firm light clay loam; the next 4 inches is brown, firm clay loam, the next 24 inches is brown, firm, gravelly clay loam; and the lower 4 inches is dark yellowish brown, firm gravelly sandy clay loam. The underlying material to a depth of 60 inches is brown stratified sand and very gravelly sand.

Available water capacity is high. Organic-matter content is moderate in the surface layer. Permeability is moderate.

Ockley soils are well suited to farming. They have slight limitations for most nonfarm uses. They are a good source of sand and gravel (fig. 8).

Representative profile of Ockley silt loam, 0 to 2 percent slopes, in a cultivated field, 2,000 feet west, 150 feet north of the southeast corner of sec. 36, T. 15 N., R. 7 E.:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; moderate medium and fine granular structure; friable; common roots; neutral; abrupt smooth boundary.

A2—8 to 13 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure;

Figure 8.—**Gravel being mined from an area of Ockley soils.**

friable; few roots; slightly acid; clear wavy boundary.

B1t—13 to 17 inches; dark yellowish brown (10YR 4/4) light clay loam; moderate medium subangular blocky structure; firm; few roots; many continuous distinct thin brown and dark brown (10YR 3/3) organic films on faces of peds; few pebbles; slightly acid; clear wavy boundary.

B21t—17 to 21 inches; brown (7.5YR 4/4) clay loam; moderate medium and coarse subangular blocky structure; firm; few roots; common discontinuous distinct thin dark brown (10YR 3/3) clay films on faces of peds; few pebbles; medium acid; clear wavy boundary.

IIB22t—21 to 45 inches; brown (7.5YR 4/4) gravelly clay loam; weak very coarse subangular blocky structure; firm; few roots; common discontinuous distinct thin dark brown (7.5YR 3/2) clay films on faces of peds and surfaces of pebbles; medium acid; clear wavy boundary.

IIB23t—45 to 49 inches; dark yellowish brown (10YR 3/4) gravelly sandy clay loam; massive; firm; common discontinuous distinct thin dark brown (7.5YR 3/2) clay films on surfaces of pebbles; slightly acid; abrupt wavy boundary.

IIIC—49 to 60 inches; brown (10YR 5/3) stratified sand and very gravelly sand; single grained; loose; violent effervescence; moderately alkaline.

The solum is 40 to 56 inches thick. The A horizon is 8 to 13 inches thick. The Ap horizon is dark yellowish brown (10YR 4/4) or brown (10YR 4/3) silt loam or loam. It is neutral to medium acid. The A2 horizon is dark yellowish brown (10YR 4/4), brown (10YR 4/3 or 5/3), or yellowish brown (10YR 5/4) silt loam or loam. It is slightly acid to medium acid.

The B horizon is 30 to 44 inches thick. It is dark yellowish brown (10YR 4/4 or 3/4), brown (7.5YR 4/4 or 5/4), or reddish brown (5YR 4/3 or 4/4) clay loam; sandy clay loam, gravelly clay loam, or gravelly sandy clay loam. The B1 horizon is silty clay loam in places. It is slightly acid to strongly acid.

The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4) stratified loamy sand, gravelly loamy sand, sand, and very gravelly sand.

Ockley soils are near Martinsville, Whitaker, Rensselaer, and Westland soils. They are similar in drainage to Martinsville and Miami soils. Ockley soils have gravel in the lower part of the B horizon and in the C horizon that is lacking in the Martinsville, Whitaker, and Rensselaer soils. They lack the mottling in the upper part of the B horizon found in Whitaker, Rensselaer, and Westland soils. Ockley soils have a lighter textured and lighter colored A horizon than Rensselaer soils. They are coarser textured and have more stratification in the lower part of the B horizon and in the C horizon than Miami soils.

OcA—Ockley silt loam, 0 to 2 percent slopes. This nearly level soil is on river terraces along the major streams. Areas are oblong in shape and 2 to 120 acres in size. This soil has the profile described as representative of the series. Slope is dominantly 1 to 2 percent. Runoff is slow.

Included with this soil in mapping are small areas of Ockley soils that are less than 40 inches deep over sand and gravel and are more droughty than this soil. There are also small areas that have slopes of more than 2 percent, areas that have slopes of more than 6 percent, and areas where sand and gravel have been mined; these areas are indicated by special symbols on the soil map. Also included are small areas of well drained Martinsville soils on slight rises and very poorly drained Westland soils and somewhat poorly drained Whitaker soils in depressions.

This Ockley soil is well suited to intensive farming if properly managed. Most areas are farmed. The soil is a good source of sand and gravel. Most woodlots are small, but they produce good quality hardwoods if they are properly managed. Capability unit I-1; woodland group 1o1.

OcB2—Ockley silt loam, 2 to 6 percent slopes, eroded. This gently sloping soil is on kames on uplands and on river terraces. Areas are oblong in shape and 2 to 40 acres in size. The soil has a profile similar to the one described as representative of the series, but because of erosion the surface layer is less than 8 inches thick and there is no subsurface layer. Runoff is medium.

Included with this soil in mapping are small areas of Ockley soils that are less than 40 inches deep over sand and gravel and are more droughty than this soil; areas that have a few cobbles and large stones that can damage farm equipment and hinder farming operations; small areas of soils that have slopes of less than 2 percent; and areas of soils that have slopes of more than 6 percent. There are also areas that have slopes of more than 12 percent; small, severely eroded areas that have a clay loam or gravelly clay loam surface layer, which has many cobbles and small stones; and areas where sand and gravel have been mined; these areas are indicated by special symbols on the soil map. Also included are small areas of well drained Martinsville soils on foot slopes and somewhat poorly drained Whitaker soils and very poorly drained Westland soils in waterways and depressions.

This Ockley soil is suited to farming. Erosion is the main hazard to farming. Most areas are farmed. The soil is a good source of sand and gravel. Woodlots are small, but they produce good quality hardwoods if they are properly managed. Capability unit IIe-3; woodland group 1o1.

OkC2—Ockley complex, 6 to 12 percent slopes, eroded. These moderately sloping soils are on kames on uplands and on river terraces. Areas are oval or long, narrow, and winding in shape. They are dominantly 2 to 10 acres in size. The Ockley soil in this complex has a profile similar to the one described as representative of the Ockley series, but the surface layer is loam or silt loam and in more eroded areas, the surface layer is clay loam and the subsurface layer is absent. In this complex are areas of soil on the convex part of slopes that are less than 40 inches deep over loose sand and gravel; areas that are severely eroded and have a clay loam or gravelly clay loam surface layer; areas where the subsoil has eroded away and loose sand and gravel are exposed at the surface; and small areas of Ockley soils that have slopes of less than 6 percent or more than 12 percent.

Included with these soils in mapping are small areas of well drained Miami soils on foot slopes and somewhat poorly drained Whitaker soils along small drainageways. There are also areas where sand and gravel have been mined and a few areas of soils that have slopes of more than 18 percent; these areas are indicated by special symbols on the soil map.

The soils in this complex are suited to farming. Erosion and droughtiness in soils that are less than 40 inches deep over sand and gravel are the main hazards to farming. Most areas are farmed. The soils are a good source of sand and gravel. Woodlots are small, but they produce good quality hardwoods if they are properly managed. Capability unit IIIe-9; woodland group 1o1.

Palms Series

The Palms series consists of deep, very poorly drained, nearly level soils. These soils are in depressions of old glacial waterways, deep depressions on uplands, and in seeps where springs come to the surface. They formed in deposits of organic material. The native vegetation was marsh grasses and a few water-tolerant hardwoods.

In a representative profile the soil is muck to a depth of 30 inches.. The upper 14 inches is black and very friable and friable, the next 12 inches is dark brown and friable, and the lower 4 inches is very dark gray and friable. The underlying material to a depth of 60 inches is dark gray loam in the upper 15 inches and dark gray gravelly loamy sand below that. Available water capacity is very high. Organic-matter content is very high. Permeability is rapid in the organic layer and moderate or moderately slow in the underlying material.

Palms soils are well suited to farming where they are adequately drained. Because of wetness and poor stability, these soils have severe limitations for most nonfarm uses.

Representative profile of Palms muck, in a cultivated field, 740 feet north, 550 feet east of the southwest corner of SE¼ sec. 9, T. 16 N., R. 7 E.:

Oap—0 to 8 inches; black (10YR 2/1) sapric material, very dark gray (10YR 3/1) rubbed; about 5 percent fiber, no fiber when rubbed; moderate fine granular structure; very friable; many roots, fibers are herbaceous; 10 percent mineral material; neutral; abrupt smooth boundary.

Oa2—8 to 14 inches; black (10YR 2/1) sapric material, very dark gray (10YR 3/1) rubbed; about 10 percent fiber, 2 percent rubbed; moderate coarse subangular blocky structure parting to moderate medium granular; friable; many roots; fibers are herbaceous; 5 percent mineral material; dark brown (7.5YR 3/2) coatings in old root channels, voids, and cleavage breaks; neutral; clear wavy boundary.

Oa3—14 to 26 inches; dark brown (7.5YR 3/2) sapric material, very dark gray (5YR 3/1) rubbed; about 30 percent fiber, 4 percent rubbed; moderate thin platy structure; friable; common roots; fibers are herbaceous; 10 percent mineral material; medium acid; clear wavy boundary.

Oa4—26 to 30 inches; very dark gray (10YR 3/1) sapric material, broken face and rubbed; about 8 percent fiber, 2 percent rubbed; weak thin platy structure; friable; few roots; fibers are herbaceous; 50 percent mineral material; neutral; abrupt wavy boundary.

IIC1g—30 to 45 inches; dark gray (5Y 4/1) loam; massive; friable; free roots; about 3 percent organic matter; few glacial pebbles; strong effervescence (25 percent calcium carbonate); moderately alkaline; clear wavy boundary.

IIC2g—45 to 60 inches; dark gray (5Y 4/1) gravelly loamy sand; massive; loose; violent effervescence (55 percent calcium carbonate); moderately alkaline.

The loamy material is at a depth of 16 to 50 inches. Where present, the Oap horizon is 6 to 10 inches thick. It is black (10YR 2/0) or very dark brown (10YR 2/2) sapric material. The Oa tiers are black (10YR 2/1, N 2/0, or 5YR 2/1), very dark gray (10YR or 5YR 3/1), dark reddish brown (5YR 2/2, 3/2, or 3/3), very dark brown (10YR or 7.5YR 2/2), very dark grayish brown (10YR 3/2)), or dark brown (7.5YR 3/2) sapric material. There are thin tiers of hemic material in some places. The organic tiers range from strongly acid to moderately alkaline.

The IICg horizon is very dark gray (10YR 3/1 or N 3/0), very dark grayish brown (10YR or 2.5Y 3/2), dark gray (10YR 4/1 or N 4/0), gray (10YR 5/1 or 6 5/0), dark grayish brown (10YR or 2.5Y 4/2), or grayish brown (10YR or 2.5Y 5/2) sandy loam to silty clay loam. In places, this horizon has mottles of yellowish brown, dark yellowish brown, or dark brown. The IICg horizon ranges from slightly acid to moderately alkaline.

Palms soils are near Milford, Rensselaer, Kokomo, Westland, and Sloan soils, and they are similar in drainage to these soils. Palms soils are high in organic-matter content and lack the high mineral content of Milford, Rensselaer, Kokomo, Westland, and Sloan soils.

Ps—Palms muck (0 to 2 percent slopes). This soil is in depressions of old glacial streams, deep depressions on uplands, and in seeps where springs come to the surface. Areas are oval or elongated in shape and 1 acre to 200 acres in size. The underlying material ranges from silty clay loam to gravelly sand. In most areas, silty clay loam, silt loam, or loam underlies the muck and coarser textured material is below the loamy material. In some areas, snail and clam shells are in the organic layers and in the upper part of the underlying material and the underlying material is high in content of lime. Slope is dominantly less than 1 percent, but it is more than 1 percent in small areas fed by springs. Runoff is very slow or ponded.

Included with this soil in mapping are areas of soils that have less than 16 inches of organic matter over the underlying material. These are some of the small depressions in upland areas and the area drained by the Mingle Ditch in the north-central part of the county. There are also some areas in which the muck is thicker than 50 inches; the main areas are ½ mile east of Maxwell. Also included are small areas of soils that have 8 to 16 inches of lighter colored silt loam or silty clay loam overwash from the adjoining soils and small areas of Rensselaer, Westland, and Milford soils on slight rises.

Wetness and poor stability are the main limitations. Open ditches, surface drains, and field tile can be used to remove excess water. Where adequately drained, the soil is suited to corn, soybeans, small grain, and many specialty crops, such as tomatoes and truck farm crops. Most areas have not been drained, and they have standing water or are saturated most of the year. Most areas are not farmed. In some areas, the muck is being mined commercially. A few areas produce very poor stands of hardwoods. Capability unit IIw-10; woodland group 4w23.

Rensselaer Series

The Rensselaer series consists of deep, very poorly drained, nearly level soils. These soils are in depressions on outwash plains, old glacial waterways, and river terraces. They formed in stratified loamy and sandy outwash. The native vegetation was marsh grasses and water-tolerant hardwoods.

In a representative profile the surface layer is very dark gray silty clay loam about 11 inches thick. The subsoil is about 31 inches thick. The upper 13 inches is mottled, dark gray, firm clay loam; the next 11 inches is mottled, gray, firm light clay loam; and the lower 7 inches is mottled, gray, firm light silty clay loam. The underlying material to a depth of 60 inches is mottled, gray, stratified fine sandy loam, silt loam, clay loam, fine sand, very fine sand, and medium sand.

Available water capacity is high. Organic-matter content is high in the surface layer. Permeability is slow.

Rensselaer soils are well suited to intensive farming where they are adequately drained (fig. 9). Because of wetness and slow permeability, these soils have severe limitations for most nonfarm uses.

Representative profile of Rensselaer silty clay loam, in a cultivated field, 1,290 feet west, 80 feet south of northeast corner of sec. 8, T. 17 N., R. 8 E.:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam; weak fine granular structure; friable; few roots; neutral; abrupt smooth boundary.

A12—9 to 11 inches; very dark gray (10YR 3/1) silty clay; moderate medium granular structure; friable; few roots; common discontinuous distinct thin dark gray (10YR 4/1) coatings on faces of peds; neutral abrupt wavy boundary.

B21tg—11 to 16 inches; dark gray (10YR 4/1) clay loam; many fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; few roots; common continuous distinct thin grayish brown (10YR 5/2) clay films on peds; neutral; abrupt wavy boundary.

B22tg—16 to 24 inches; dark gray (10YR 4/1) clay loam; many fine distinct brown (10YR 4/3) and dark yellowish brown (10YR 4/4) mottles; moderate fine and medium subangular blocky structure; firm; few roots; many continuous distinct thin gray (10YR 5/1) clay films on faces of peds; neutral; clear wavy boundary.

Figure 9.—**Concrete tile being installed in Rensselaer silty clay loam to improve drainage.**

B23tg—24 to 35 inches; gray (10YR 5/1) light clay loam; many coarse distinct yellowish brown (10YR 5/8) and brown (7.5YR 4/4) mottles; moderate coarse prismatic structure parting to moderate coarse subangular blocky; firm; few roots; many continuous distinct thin grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear wavy boundary.

B3g—35 to 42 inches; gray (10YR 5/1 and 6/1) light silty clay loam; many coarse distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak coarse subangular blocky structure; firm; few roots; many continuous distinct thin dark gray (10YR 4/1) coatings in root channels; neutral; abrupt wavy boundary.

C1g—42 to 52 inches; gray (10YR 5/1), grayish brown (10YR 5/2), yellowish brown (10YR 5/6), and dark yellowish brown (10YR 4/4) stratified clay loam, fine sandy loam, and fine sand; massive and single grained; very friable and loose; slight effervescence (8 percent calcium carbonate); mildly alkaline; abrupt wavy boundary.

C2g—52 to 60 inches; gray (10YR 5/1) stratified silt loam, very fine sand, and medium sand; massive and single grained; loose and very friable; violent effervescence (35 percent calcium carbonate); moderately alkaline.

The solum is 38 to 60 inches thick. The A1 horizon is 10 to 16 inches thick. It is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2) silty clay loam, clay loam, or silt loam. It is neutral or slightly acid.

The B horizon is gray (10YR 5/1, 10YR 6/1, or N 5/0), dark gray (10YR 4/1 or N 4/0), dark grayish brown (10YR 4/2), or grayish brown (10YR 5/2) stratified clay loam, silty clay loam, sandy clay loam, or loam. It has mottles of dark yellowish brown, brown, or yellowish brown. The B2 horizon is slightly acid to neutral, and the B3 horizon is neutral or mildly alkaline.

The C horizon is gray (10YR 5/1 or 6/1) or grayish brown (10YR 5/2), and it has yellowish brown or dark yellowish brown mottles. It is stratified sand, sandy loam, loamy sand, silt loam, loam, or light clay loam.

Rensselaer soils are near Whitaker, Martinsville, Ockley, Brookston, Crosby, and Westland soils. They are similar in drainage to Brookston and Westland soils. Rensselaer soils have a darker colored, heavier textured A horizon than Whitaker, Crosby, Ockley, and Martinsville soils. They have more stratification in the lower part of the subsoil and in the stratified underlying material than Brookston soils. Rensselaer soils lack gravel in the lower part of the B horizon and in the C horizon that is present in Westland soils.

Re—Rensselaer silty clay loam (0 to 2 percent slopes). This nearly level soil is in depressions on outwash plains, old glacial waterways, and river terraces. Areas are irregular in shape and 5 to 300 acres in size. Slope is dominantly less than 1 percent. Runoff is very slow. Some areas are ponded.

Included with this soil in mapping are small areas of soils in which the upper part of the subsoil is silty clay loam as much as 36 inches thick. Also included are small areas of soil that have 8 to 16 inches of lighter colored silt loam or loam overwash on the surface. This material washed from adjoining soils. More sloping soils along some narrow drainageways are included. There are also undrained areas that stay wet most of the year and areas where water ponds for long periods; these areas are indicated by special symbols on the soil map. Also included are small areas of Whitaker and Martinsville soils on rises, Milford and Westland soils in the deeper depressions, and Sloan soils in small drainageways.

Wetness is the main limitation. The soil becomes hard, cloddy, and difficult to farm if plowed when it is wet. Field tile, surface drains, and open ditches can be used to remove excess water. Some areas have layers of fine sand that flow into and fill a tile and that cause ditchbanks to slough. These areas need special attention in engineering. Where adequately drained, the soil is well suited to intensive corn, soybeans, and small grain. Most areas are farmed. Wooded areas are small, and they mostly produce poor quality hardwoods. Capability unit IIw-1; woodland group 2w11.

Shoals Series

The Shoals series consists of deep, somewhat poorly drained, nearly level soils. These soils are in bottom lands of small streams. They formed in recent loamy alluvium. The native vegetation was water-tolerant hardwoods.

In a representative profile the surface layer is dark grayish brown silt loam about 11 inches thick. The underlying material to a depth of 60 inches is 15 inches of mottled, grayish brown stratified loam, silt loam, and clay loam; 9 inches of mottled, gray clay loam; and 25 inches of mottled, grayish brown stratified loam, clay loam, silt loam, and sandy loam.

Available water capacity is high. Organic-matter content is medium in the surface layer. Permeability is moderate.

Shoals soils are well suited to farming if they are adequately drained and protected from flooding. Because of wetness and flooding, these soils have severe limitations for most nonfarm uses.

Representative profile of Shoals silt loam, in a cultivated field, 850 feet south, 650 feet west of the northeast corner of sec. 20, T. 15 N., R. 6 E.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; common roots; many continuous faint thin very dark gray (10YR 3/1) organic films on faces of peds; neutral; abrupt smooth boundary.

A12—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium subangular blocky structure; friable; few roots; many continuous faint thin very dark grayish brown (10YR 3/2) organic films on faces of peds; neutral; abrupt smooth boundary.

C1—11 to 26 inches; grayish brown (10YR 5/2) stratified loam; silt loam, and clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; few roots; common fine dark yellowish brown (10YR 3/4) soft iron and manganese oxides concentrations; neutral; clear wavy boundary.

C2g—26 to 35 inches; gray (10YR 5/1) light clay loam; many coarse prominent brown (7.5YR 4/4) mottles; massive; friable; few roots; neutral; clear wavy boundary.

C3—35 to 60 inches; grayish brown (10YR 5/2) stratified loam, silt loam, clay loam, and sandy loam; many medium distinct brown (7.5YR 4/4) and yellowish brown (10YR 5/6) mottles; massive; friable; few roots; few continuous distinct thin very dark grayish brown (10YR 3/2) organic films in root channels; slight effervescence (5 percent calcium carbonate); mildly alkaline.

The A horizon is 8 to 16 inches thick. It is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2) silt loam or loam. It is neutral or slightly acid.

The C horizon is gray (10YR 5/1), grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or dark gray (10YR 4/1) stratified loam, silt loam, clay loam, sandy loam, sand, and very gravelly sand. Mottles are brown, strong brown, and yellowish brown. The C horizon is neutral to moderately alkaline.

Shoals soils are near Sloan, Eel, and Genesee soils. They have a lighter colored and lighter textured A horizon than Sloan soils. Shoals soils have mottling with a depth of 20 inches of the surface that is lacking in Genesee soils. They are grayer in the upper part of the C horizon than Eel soils.

Sh—Shoals silt loam (0 to 2 percent slopes). This soil is on bottom lands along rivers and streams. Areas are long and narrow in shape and 10 to 350 acres in size. Slope is dominantly less than 1 percent. Runoff is very slow.

Included with this soil in mapping are small, undrained areas that stay wet most of the year, some small areas of soils next to the stream channel that have a sandy loam surface layer, and some small areas of soils that are underlain by sand and gravel within 24 inches of the surface. There are also areas that are underlain by sand and gravel that have been mined or are being mined and areas where seeps from adjoining soils on uplands or terraces formed small pockets of muck; these areas are indicated by special symbols on the soil map. Also included are small areas of Sloan soils in depressions, Eel and Genesee soils next to stream channels, and Whitaker soils at slightly higher elevations.

Flooding and wetness are the main limitations. Because water moves freely through the soil, tile is suited for drainage if an adequate outlet is available. The soil is subject to flooding from nearby streams, and in some years replanting or late planting is necessary. Crops are subject to flood damage from heavy summer rain. The soil is suited to row crops and the larger bottoms are farmed. Small, narrow bottoms are dominantly in pasture or woodland. Most woodlots produce poor quality hardwoods. Capability unit IIw-7; woodland group 2w13.

Sloan Series

The Sloan series consists of deep, very poorly drained, nearly level soils. These soils are in depressional areas on bottom lands of larger streams and in narrow areas of bottom lands of small streams. They formed in recent loamy alluvium. The native vegetation was water-tolerant hardwoods and marsh grasses.

In a representative profile the surface layer is very dark gray and very dark grayish brown light silty clay loam about 13 inches thick. The subsoil is about 21 inches thick. The upper 7 inches is mottled, dark gray, firm light clay loam; the next 6 inches is mottled, gray, firm clay loam; and the lower 8 inches is mottled, gray, friable heavy loam. The underlying material to a depth of 60 inches is dark grayish brown stratified sandy loam, loam, and loamy very coarse sand.

Available water capacity is high. Organic-matter content is high in the surface layer. Permeability is moderate.

Sloan soils are well suited to farming if they are adequately drained and protected from flooding. Because of wetness and flooding, these soils have severe limitations for most nonfarm uses.

Representative profile of Sloan silty clay loam, in a pasture, 620 feet north, 190 feet east of the southwest corner of sec. 16, T. 16 N., R. 7 E.:

Ap—0 to 8 inches; very dark (10YR 3/1) light silty clay loam; moderate medium granular structure; friable; common roots; neutral; clear smooth boundary.

A12—8 to 13 inches; very dark grayish brown (10YR 3/2) light silty clay loam; moderate fine granular structure; friable; few roots; neutral; clear wavy boundary.

B21g—13 to 20 inches; dark gray (10YR 4/1) light clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; moderate fine granular structure; firm; few roots; few pebbles; neutral; clear wavy boundary.

B22g—20 to 26 inches; gray (10YR 5/1) clay loam; many fine distinct brown (7.5YR 4/4) and dark yellowish brown (10YR 3/4) mottles; weak fine granular structure; firm; few roots; neutral; clear wavy boundary.

B23g—26 to 34 inches; gray (10YR 5/1) heavy loam; many coarse distinct brown (7.5YR 4/4) and dark yellowish brown (10YR 3/4) mottles; massive; friable; few roots; neutral; abrupt wavy boundary.

Cg—34 to 60 inches; dark grayish brown (10YR 4/2) stratified sandy loam, loam, and loamy very coarse sand; massive and single grained; very friable and loose; common pebbles; strong effervescence (10 percent calcium carbonate); moderately alkaline.

The A horizon is 10 to 16 inches thick. It is black (10YR 2/1), very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or very dark brown (10YR 2/2) silty clay loam, clay loam, or silt loam. It is slightly acid to mildly alkaline.

The B horizon is dark gray (10YR 4/1 or N 4/0), dark grayish brown (10YR 4/2), or gray (10YR 5/1 or N 5/0) loam, silty clay loam, clay loam, or sandy loam. It has dark yellowish brown, brown, or yellowish brown mottles. The B horizon is neutral to mildly alkaline.

The C horizon is dark gray (10YR 4/1), dark grayish brown (10YR 4/2), or gray (10YR 5/1) stratified loam, sandy loam, loamy sand, sand, or gravelly sand. It is neutral to moderately alkaline.

Sloan soils are near Shoals, Eel, Genesee, Westland, and Rensselaer soils. They are similar in drainage to Westland and Rensselaer soils. Sloan soils have a darker colored, heavier textured A horizon than Shoals, Eel, and Geneese soils. They lack the Bt horizon present in Westland and Rensselaer soils.

So—Sloan silty clay loam (0 to 2 percent slopes). This soil is on bottom lands along small creeks and streams and in the low, slackwater areas of larger river bottoms. Areas are elongated in shape and 5 to 250 acres in size. Slope is dominantly less than 1 percent. Runoff is very slow or ponded.

Included with this soil in mapping are small areas of this Sloan soil where the upper part of the subsoil is more than 35 percent clay and some small areas of soils that are underlain by sand and gravel within a depth of 24 inches of the surface. There are also small, undrained areas that stay wet most of the year, areas where water stands most of the year, and areas underlain by sand and gravel that are being mined or have been mined; these areas are indicated by special symbols on the soil map. Also included are small areas of Shoals soils near stream channels and Rensselaer and Westland soils on low, narrow terraces.

Flooding and wetness are the main limitations. Tile drains, surface drains, and open ditches can be used to remove excess surface and groundwater if adequate outlets are available. The soil is subject to frequent flooding from nearby streams. Where adequately drained, it is suited to row crops. Crops are subject to flood damage from heavy summer rain. In some years replanting or late planting is necessary. Larger bottoms that can be drained are farmed. Small, narrow bottoms or undrained bottoms are dominantly in pasture or left in woodland. Most wooded areas produce poor quality hardwoods. Capability unit IIIw-9; woodland group 2w11.

Westland Series

The Westland series consists of deep, very poorly drained, nearly level soils. These soils are in depressions on outwash plains and river terraces. They formed in loamy outwash and the underlying gravelly glacial outwash. The native vegetation was water-tolerant hardwoods and marsh grasses.

In a representative profile the surface layer is very dark gray clay loam about 11 inches thick. The subsoil is about 37 inches thick. The upper 16 inches is mottled, dark gray, firm clay loam; the next 5 inches is mottled, gray, firm silty clay loam; the next 6 inches is mottled, gray, firm gravelly clay loam; and the lower 10 inches is mottled, gray, friable gravelly loam. The underlying material to a depth of 60 inches is mottled, dark gray very gravelly loamy sand.

Available water capacity is high. Organic-matter content is high in the surface layer. Permeability is slow.

Westland soils are well suited to intensive farming where they are adequately drained. Because of wetness and slow permeability, these soils have severe limitations for most nonfarm uses. They are a good source of sand and gravel.

Representative profile of Westland clay loam, in a cultivated fields, 80 feet west, 140 feet north of southeast corner of NW¼ of sec. 32, T. 15 N., R. 8 E.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) light clay loam; weak fine granular structure; firm; common roots; dark brown (7.5YR 4/4) films on surfaces of old root channels; common pebbles; neutral; abrupt smooth boundary.

A12—8 to 11 inches; very dark gray (N 3/0) clay loam; few fine distinct dark brown (7.5YR 4/4) mottles; moderate very fine subangular blocky structure; friable; few roots; few pebbles; neutral; clear wavy boundary.

B21tg—11 to 14 inches; dark gray (10YR 4/1) clay loam; common fine distinct yellowish brown (10YR 5/6) and reddish brown (5YR 4/4) mottles; moderate fine angular and subangular blocky structure; firm; few roots; common discontinuous distinct thin very dark gray (10YR 3/1) organic films on faces of peds; few pebbles; neutral; gradual wavy boundary.

B22tg—14 to 27 inches; dark gray (10YR 4/1) clay loam; many medium distinct dark brown (7.5YR 4/4) and yellowish brown (10YR 5/4) mottles; moderate fine and medium angular and subangular blocky structure; firm; few fine roots; many continuous distinct thin dark gray (10YR 4/1) clay films on faces of peds; common continuous distinct thin very dark gray (10YR 3/1) organic films on vertical faces of peds; few small hard black (10YR 2/1) iron and manganese oxide concretions; common glacial pebbles; neutral; clear wavy boundary.

B23tg—27 to 32 inches; gray (10YR 5/1) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate coarse angular and subangular blocky; firm; few fine roots; common discontinuous distinct thin dark gray (10YR 4/1) clay films on faces of peds; few discontinuous distinct thin very dark gray (10YR 3/1) organic films on vertical faces of peds and root channels; few pebbles; coarse sand grains on faces of peds; neutral; abrupt wavy boundary.

IIB24tg—32 to 38 inches; gray (10YR 5/1) gravelly clay loam; many medium distinct dark gray (10YR 4/1) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; few discontinuous distinct thin dark gray (10YR 4/1) clay films on faces of peds, in voids, and on surfaces of pebbles; few discontinuous distinct medium very dark gray (N 3/9) organic films on vertical faces of peds; neutral; clear wavy boundary.

IIB3g—38 to 48 inches; gray (10YR 5/1) loam; many medium faint dark gray (10YR 4/1) mottles and many medium distinct yellowish brown (10YR 5/6 and 5/4) mottles; weak very coarse subangular blocky structure; friable; few discontinuous distinct medium dark gray (10YR 4/1) clay films on vertical faces of peds and in voids; neutral; gradual wavy boundary.

IIICg—48 to 60 inches; dark gray (10YR 4/1) very gravelly loamy sand; many coarse distinct brown (10YR 5/3) mottles; massive; very friable; violent effervescence (40 percent calcium carbonate); moderately alkaline.

The solum is 40 to 56 inches thick. The A1 horizon is 10 to 15 inches thick. It is black (10YR 2/1 or N 2/0), very dark brown (10YR 2/2), very dark gray (10YR 3/1 or N 3/0), or very dark grayish brown (10YR or 2.5YR 3/2) clay loam or silty clay loam. A few dark brown mottles are in the A12 horizon in many places. The A horizon is neutral or slightly acid.

The B horizon is dark gray (10YR 4/1, N 4/0, or 5Y 5/1). It has mottles of dark brown, yellowish brown, or reddish brown. The B1, B21, and B22 horizons are clay loam, silty clay loam, or gravelly clay loam, and the B23 horizon and B3 horizon are gravelly clay loam to very gravelly loamy sand. The B2 horizon is neutral or slightly acid, and the B3 horizon is neutral to moderately alkaline.

The C horizon is mottled gray (10YR 5/1 or N 5/0) or dark gray (10YR 4/1 or 6 4/0) very gravelly loamy sand or very gravelly sand.

Westland soils are near Ockley, Martinsville, Whitaker, Rensselaer, and Sloan soils. They are similar in drainage to Rensselaer and Sloan soils. Westland soils have mottles throughout the B horizon, but Ockley and Martinsville soils do not. They have a heavier textured, darker colored B horizon than Whitaker, Ockley, and Martinsville soils. Westland soils have gravel in the lower part of the B horizon and in the C horizon that Renssalaer soils lack. They have a Bt horizon that Sloan soils do not have.

We—Westland clay loam (0 to 2 percent slopes). This soil is in depressions and narrow drainageways on glacial outwash plains and river terraces. Areas are oblong or long and narrow in shape and about 2 to 30 acres in size. Slope is dominantly less than 1 percent. Runoff is very slow or ponded.

Included with this soil in mapping are small areas of this Westland soil in which the surface layer is less than 10 inches thick, some areas in which the combined thickness of the surface layer and subsoil is less than 30 inches, and small areas that have 8 to 16 inches of lighter colored silt loam or loam overwash from the adjoining soils. There are also undrained areas that stay wet most of the year, areas where water ponds for long periods of the year, and small areas that have a layer of organic material on the surface; these areas are indicated by special symbols on the soil map. Also included are areas of Whitaker soils on slight rises.

Wetness is the main limitations. Surface drains and tile can be used to remove excess water. Some areas have layers of fine sand that can flow into and fill the tile. Where adequately drained and properly managed, the soil is suited to intensive cropping. Most areas are farmed. The soil is a good source of sand and gravel. Wooded areas are small, and they mostly produce poor quality hardwoods. Capability unit IIw-1; woodland group 2w11.

Whitaker Series

The Whitaker series consists of deep, somewhat poorly drained, nearly level soils. These soils are in low, flat areas on river terraces and outwash plains. They formed in stratified loamy and sandy outwash. The native vegetation was hardwoods.

In a representative profile the surface layer is dark grayish brown loam about 9 inches thick, and the subsurface layer is mottled, light brownish gray loam about 2 inches thick. The subsoil is about 45 inches thick. The upper 13 inches is mottled, yellowish brown, firm clay loam; the next 9 inches is mottled, grayish brown, friable sandy clay loam; and the lower 17 inches is mottled, grayish brown, friable stratified sandy loam and loam. The underlying material to a depth of 60 inches is yellowish brown and grayish brown stratified sandy loam, loamy sand, and sand.

Available water capacity is high. Organic-matter content is moderate in the surface layer. Permeability is moderate.

Whitaker soils are suited to intensive farming where they are adequately drained and properly managed. Because of wetness, these soils have moderate to severe limitations for most nonfarm uses.

Representative profile of Whitaker loam, in a cultivated field, 300 feet west, 125 feet south of the northeast corner of NW¼ of sec. 24, T. 17 N., R. 6 E.:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; moderate fine granular structure; friable; few roots; neutral; abrupt smooth boundary.

A2—9 to 11 inches; light brownish gray (10YR 6/2) loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium granular structure; friable; few roots; slightly acid; abrupt wavy boundary.

B21t—11 to 24 inches; yellowish brown (10YR 5/6) clay loam; common distinct medium grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few roots; many continuous distinct thin dark grayish brown (10YR 4/2) clay films on faces of peds; many continuous prominent thick light brownish gray (10YR 6/2) silt coatings on vertical faces; few hard black (10YR 2/1) iron and manganese oxide concretions; strongly acid; abrupt wavy boundary.

B22t—24 to 33 inches; yellowish brown (10YR 5/6) light clay loam; many medium distinct dark grayish brown (10YR 4/2) and gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; few roots; common continuous distinct thin grayish brown (10YR 6/2) clay films on faces of peds; few hard black (10YR 2/1) iron and manganese oxide concretions; neutral; abrupt smooth boundary.

B23tg—33 to 39 inches; grayish brown (10YR 5/2) sandy clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular and angular blocky structure; friable; few roots; few patchy distinct thin gray (10YR 5/1) clay films on faces of peds; neutral; abrupt wavy boundary.

B3g—39 to 56 inches; grayish brown (10YR 5/2) stratified sandy loam and loam; common coarse distinct yellowish brown (10YR 5/6) mottles; weak very coarse subangular blocky structure; friable; few pebbles; slight effervescence (15 percent calcium carbonate); moderately alkaline; abrupt wavy boundary.

C—56 to 60 inches; yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) stratified sandy loam, loamy sand, and sand; massive and single grained; very friable and loose; violent effervescence (35 percent calcium carbonate); moderately alkaline.

The solum is 42 to 60 inches thick. The A horizon is 8 to 16 inches thick. The Ap horizon is dark gray (10YR 4/1), dark grayish brown (10YR 4/2), or dark brown (10YR 4/3) loam or silt loam. The A2 horizon is grayish brown (10YR 5/2) or light brownish gray (10YR 6/2) loam or silt loam, and it has yellowish brown or strong brown mottles. The A horizon is neutral to medium acid.

The B horizon is yellowish brown (10YR 5/4 or 5/6), grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or brown (10YR 5/3) clay loam, silty clay loam, sandy clay loam, or sandy loam. It has mottles of gray, dark gray, dark grayish brown, yellowish brown, grayish brown, or light brownish gray. The B2 horizon is neutral to strongly acid, and the B3 horizon is slightly acid to moderately alkaline.

The C horizon is mottled yellowish brown (10YR 5/4 or 5/6), brown (10YR 5/3), grayish brown (10YR 5/2), gray (10YR 5/1), or light brownish gray (10YR 6/2) stratified loam, silt loam, sandy loam, loamy sand, and sand.

Whitaker soils are near Ockley, Martinsville, Rensselaer, Westland, Shoals, and Sloan soils. They are similar in drainage to Shoals and Crosby soils. Whitaker soils have grayish mottling within 18 inches of the surface that is lacking in Ockley and Martinsville soils. They have a lighter colored and lighter textured A horizon than Rensselaer, Westland, and Sloan soils. Whitaker soils have stratification of materials in the lower part of the B horizon and in the C horizon that Crosby soils lack. They have a B horizon that Shoals soils lack.

Wh—Whitaker loam (0 to 2 percent slopes). This nearly level soil is on outwash plains, old glacial waterways, and river terraces. Areas are irregular in shape and 5 to 40 acres in size. Slope is dominantly 1 to 2 percent. Runoff is slow.

Included with this soil in mapping are areas of Whitaker soils that formed in as much as 39 inches of silty sediment over the loamy sediment. Some areas of Whitaker soil adjacent to Fox and Westland soils have more gravel in the subsoil and underlying material than is representative of the Whitaker series and in many of these areas, the combined thickness of the surface layer and subsoil is less than 36 inches. Small depressions that stay wet most of the year are indicated by a special symbol on the soil map. Also included are small areas of Rensselaer and Westland soils in depressions, Martinsville and Ockley soils on rises, and Shoals and Sloan soils in narrow waterways.

Wetness is the main limitation. Tile can be used to remove excess water. Some areas have layers of fine sands that can flow into the tile and fill them. Where adequately drained and properly managed, the soil is suited to intensive cropping. Most areas are farmed. Wooded areas are small, and they mostly produce poor quality hardwoods. Capability unit IIw-2; woodland group 3w5.

Use and Management of the Soils

This section gives general information on the use and management of the soils of Hancock County for cultivated crops and forage, wildlife, trees, engineering structures and practices, town and country planning, and recreation. Predicted yields of important crops are also given.

Specific management for individual soils is not suggested in this section. Detailed information on the uses and management for specified soils in the county can be provided by the local office of the Soil Conservation Service or by the Hancock County Cooperative Extension Service.

Crops and Pasture

About 80 percent of Hancock County is used for crops and pasture. The main crops are corn, soybeans, small grain, and grasses and legumes for forage. A small acreage is used for special crops, which include apples, sweet corn, popcorn, tomatoes, and nursery stock for landscaping.

Some of the major concerns in management are wetness, soil blowing and water erosion, maintenance of fertility and organic-matter content, and maintenance of good tilth or improvement of tilth. Of the intensively cultivated acreage, about 84 percent is limited by wetness, 11 percent is limited by erosion, and 5 percent has few limitations for crops.

The major management practices are installing suitable tile drainage systems, grassing waterways, farming on the contour, diversion terracing, grade stabilizing, and minimum tillage. Also major in management are using crop residue, green manure crops, and winter cover crops and, for most of the soils, applying lime and fertilizer in amounts indicated by tests and field trials.

On the pages that follow, the system of capability grouping used by the Soil Conservation Service is discussed, the properties of the soils in each capability unit are described, and management suited to the soils in each unit is suggested. Predicted yields of the principal crops are given for all the soils in the county.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for wildlife, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These levels are discussed in the following paragraphs:

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants, require special conservation practices, or both.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat. (None in the county.)
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat. (None in the county.)
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or to esthetic purposes. (None in the county.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, hay, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIw-7 or IIIe-9. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass or kind of limitation as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Capability unit numbers are generally assigned locally but are part of a statewide system. All of the units of the system are not represented in Hancock County; therefore, the capability unit numbers in this soil survey are not consecutive.

Management by capability units

The soils in Hancock County have been placed in capability units. The soils in each unit have about the same limitations, are subject to similar risks of damage, need about the same kind of management, and respond to management in about the same way.

In the following pages each capability unit is described and management for each is discussed. To find the capability unit assigned to any specific soil, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I-1

This unit consists of deep, well drained, medium textured, nearly level soils. These soils formed in loamy, sandy, and gravelly glacial outwash on outwash plains and river terraces and in loamy glacial till on uplands.

Runoff is slow. The hazard of erosion is none to slight. Available water capacity is high. Organic-matter content is moderate in the surface layer, and natural fertility is low.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and small grains are the main crops grown, but the soils are also suited to grasses, legumes, and special crops, such as tomatoes.

These soils are easy to cultivate. They produce well and need few management practices. Improving fertility and maintaining organic-matter content and tilth are the main concerns in management. Proper use of crop residue and green manure crops maintains organic-matter content and soil tilth. If properly managed, the soils are well suited to intensive row cropping.

CAPABILITY UNIT I-2

This unit consists of deep, moderately well drained and well drained, medium textured, nearly level soils. These soils formed in recent loamy alluvium on bottom lands of major streams.

Runoff is very slow. The hazard of erosion is none to slight except for cutting along streambanks. Available water capacity is high. Organic-matter content is moderate in the surface layer, and natural fertility is high. The soils are subject to occasional flooding after heavy rain. In most areas, sediment accumulates from floodwaters.

These soils are suited to row crops. Corn and soybeans are commonly grown.

These soils are easy to cultivate. They produce well but need some management. Flood protection and maintaining organic-matter content, fertility, and tilth are the main concerns in management. Small grain, grasses, and legumes are severely damaged by flooding. Levees and diversions can be used to protect the soils from flooding. Proper use of crop residue and green manure crops maintains organic-matter content and soil tilth. If properly managed, the soils are suited to intensive row cropping. If protected from flooding, they are suited to all crops commonly grown in the county.

CAPABILITY UNIT IIe-1

This unit consists of deep, well drained, medium textured, gently sloping soils. These soils formed in loamy and sandy outwash on outwash plains and river terraces and in loamy glacial till on uplands.

Runoff is medium, and there is a hazard of erosion. Available water capacity is high. Organic-matter content is moderate in the surface layer, and the natural fertility is low.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and small grain are the main crops grown, but the soils are also well suited to grasses, legumes, and special crops, such as tomatoes.

These soils are easy to cultivate. They produce well but need proper management. Controlling erosion, improving organic-matter content, maintaining a high level of fertility, and maintaining good soil tilth are the main concerns in management. Farming on the contour, minimum tillage, and sod waterways are practices that can be used to control erosion. Tile drains are needed in some of the wet waterways to remove excess water. Proper use of crop residue and green manure crops increases organic-matter content and improves soil tilth. The soils are suited to row cropping, but a cropping system that incorporates small grain and grasses and legumes for forage is needed to prevent excessive soil loss through erosion.

CAPABILITY UNIT IIe-3

Ockley silt loam, 2 to 6 percent slopes, eroded, is the only soil in this unit. It is a deep, well drained, medium textured, gently sloping soil that formed in loamy outwash and the underlying sand and gravelly outwash on outwash plains, kames, and river terraces.

Runoff is medium, and there is a hazard of erosion. Available water capacity is high. Organic-matter is moderate in the surface layer, and natural fertility is low.

This soil is suited to all crops commonly grown in the county. Corn, soybeans, and small grain are the main crops grown, but the soil is also suited to grasses, legumes, and special crops, such as tomatoes.

This soil is easy to cultivate, but small areas are stony. The soil produces well but needs proper management. Controlling erosion, improving organic-matter content, maintaining a high level of fertility, and maintaining soil tilth are the main concerns in management. Farming on the contour, minimum tillage, and leaving sod waterways are practices that can be used to control erosion. Proper use of crop residue and green manure crops increases organic-matter content and improves soil tilth. The soil is suited to row crops, but a cropping system that incorporates small grain and grasses and legumes for forage is needed to prevent excessive soil loss through erosion.

CAPABILITY UNIT IIw-1

This unit consists of deep, very poorly drained, moderately fine textured, nearly level soils. These soils formed in loamy, silty, and clayey sediment and the underlying glacial till in depressions on uplands and in loamy, sandy, and gravelly outwash in depressions on outwash plains and river terraces.

Runoff is very slow or ponded. The hazard of erosion is none to slight. Available water capacity is high. Organic-matter content is high in the surface layer, and natural fertility is high.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and small grain are the main crops grown, but the soils are also suited to grasses, legumes, and special crops, such as tomatoes.

These soils must be plowed when moisture conditions are right, or the surface layer, on drying, forms clods that are hard to break up when preparing a seedbed. The soils produce well under good management. Lowering the seasonal high water table, removing ponded surface water, maintaining a high level of fertility and organic-matter content, and improving soil tilth are the main concerns in management. Surface drains, tile, and open ditches can be used to remove excess water (fig. 10). Green-manure crops can be used to maintain organic-matter content and improve soil tilth. Deep-rooted legumes can be used to improve internal water and air movement. If properly drained and managed, the soils are suited to intensive row cropping.

CAPABILITY UNIT IIw-2

This unit consists of deep, somewhat poorly drained, medium textured, nearly level soils. These soils formed in loamy glacial till on uplands and in stratified loamy and sandy outwash on outwash plains and river terraces.

Runoff is slow. Organic-matter content is moderate in the surface layer, and natural fertility is low.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and small grain are the

Figure 10.—**Open ditch in Brookston silty clay loam used to remove excess water from cropland.**

main crops grown, but the soils are also suited to grasses, legumes, and special crops, such as tomatoes.

These soils are easy to cultivate. They produce well under proper management. Lowering the seasonal high water table, improving fertility, improving organic-matter content, and maintaining good soil tilth are the main concerns in management. Tiles that have adequate outlets can be used to remove excess groundwater. Proper use of crop residue and green-manure crops can increase organic-matter content and improve soil tilth. Deep-rooted legumes can be used to improve water and air movement. If adequately drained and properly managed, the soils are suited to intensive row cropping.

CAPABILITY UNIT IIw-7

Shoals silt loam is the only soil in this unit. It is a deep, somewhat poorly drained, medium textured, nearly level soil that formed in recent loamy alluvium on bottom lands along streams.

Runoff is very slow. The hazard of erosion is none to slight except for cutting along streambanks. Available water capacity is high. Organic-matter content is moderate in the surface layer, and natural fertility is high. The soil is subject to flooding after heavy rain. In most areas, sediment accumulates from floodwater.

This soil is suited to row crops. Corn and soybeans are commonly grown.

This soil is easy to cultivate. Crops produce and respond well under good management. Flood protection, lowering the seasonal high water table, increasing organic-matter content, and maintaining a high level of fertility and soil tilth are the main concerns in management. Tile drains that have adequate outlets can be used to remove excess groundwater. Some areas have layers of water-bearing fine sand that can flow into and fill the tile. Small grain, grasses, and legumes are severely damaged by flooding; levees and diversions can be used to protect the soils from flooding. If adequately drained and protected from flooding, the soil is suited to all crops commonly grown in the county.

CAPABILITY UNIT IIw-10

Palms muck is the only soil in this unit. This is a deep, very poorly drained, nearly level soil. It formed in deposits of organic material in deep depressions on uplands, in depressions on old glacial streambanks, and in seeps where springs come to the surface.

Runoff is very slow or ponded. The hazard of erosion is none to slight. Soil blowing is a hazard if this soil is fall plowed, because the light organic material is easily blown. The available water capacity is very high. Organic-matter content is very high, and natural fertility is high.

This soil is suited to all crops commonly grown in the county if it is adequately drained. Most areas have not been adequately drained, and those areas support cattails and willows.

This soil is easy to cultivate. Crops produce well under good management. Lowering the high water table and removing ponded surface water are the main concerns in management. Surface drains, tile, and open ditches can be used, but installing, maintaining, and keeping the tiles alined are difficult. Tiles are more stable if they are installed in the underlying mineral material, but in some areas the mineral material is water-bearing fine sand and silt, which can flow through the slots and fill the tile. Unstable underlying material can cause side slopes to slough into the ditch. Also, if the soil is drained, organic matter settles and the improved aeration of the soil causes the organic matter to slowly decompose. If properly drained and managed, this soil is suited to intensive row cropping (fig. 11). It is also well suited to truck crops.

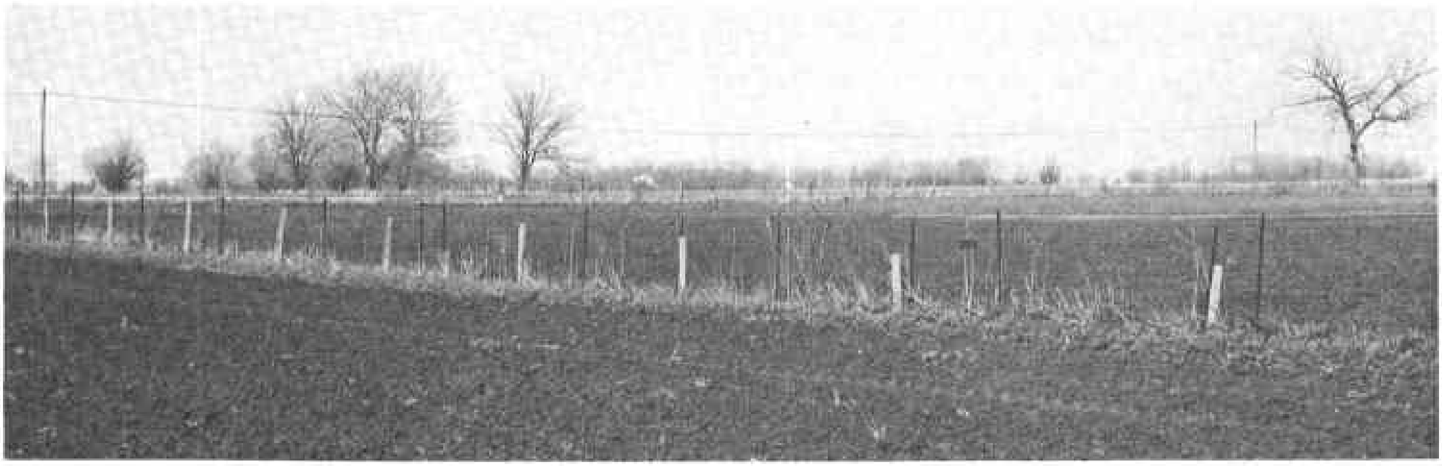

Figure 11.—**This fence line runs through a small pocket of Palms muck on uplands. Concrete posts have sunk into this unstable organic soil.**

CAPABILITY UNIT IIIe-1

Miami silt loam, 6 to 12 percent slopes, eroded, is the only soil in this unit. It is a deep, well drained, medium textured, moderately sloping soil that formed in loamy glacial till on uplands.

Runoff is medium to rapid, and the hazard of erosion is severe. Available water capacity is high. Organic-matter content is moderate in the surface layer, and natural fertility is low.

This soil is suited to all crops commonly grown in the county. Corn, soybeans, and small grain are the main crops grown, but the soil is well suited to grasses and legumes.

This soil is moderately easy to cultivate. Plows turn over some of the heavy subsoil that forms clods that are hard to work into a suitable seedbed. Controlling erosion, maintaining fertility, and improving organic-matter content and soil tilth are the main concerns in management. Farming on the contour, terraces, minimum tillage, and leaving sod waterways are some practices that can be used to control erosion. Proper use of crop residue increases organic-matter content and improves soil tilth. The soil is suited to moderate row cropping, but a cropping system that incorporates small grain and grasses and legumes for forage is needed to prevent excessive soil loss through erosion.

CAPABILITY UNIT IIIe-9

The only soil in this unit is Ockley silt loam, 2 to 6 percent slopes, eroded. It is a deep, well drained, medium textured, moderately sloping soil. It formed in loamy outwash and gravelly outwash on outwash plains, kames, and river terraces.

Runoff is medium to rapid. The hazard of erosion is severe. Available water capacity is high. Organic-matter content is moderate in the surface layer, and natural fertility is low.

This soil is suited to all crops commonly grown in the county. Corn, soybeans, and small grain are the main crops grown, but the soil is well suited to grasses and legumes.

This soil is moderately easy to cultivate, except in small, severely eroded areas where the plow has to turn over the heavy clay subsoil. These small areas form clods and are stony, which make them hard to work into a suitable seedbed. Controlling erosion, maintaining fertility, improving organic-matter content and soil tilth are the main concerns in management. Farming on the contour, terracing, minimum tillage and leaving waterways in sod are some practices that can be used to control erosion. Proper use of crop residue increases organic-matter content and improves soil tilth. The soils are droughty during extended dry periods, and crops are subject to damage by lack of moisture. The soils are suited to moderate row cropping, but a cropping system that incorporates small grain and grasses and legumes for forage is needed to prevent excessive soil loss through erosion.

CAPABILITY UNIT IIIw-9

Sloan silty clay loam is the only soil in this unit. It is a deep, very poorly drained, moderately fine textured, nearly level soil that formed in recent loamy alluvium on the bottom lands along streams.

Runoff is very slow or ponded. The hazard of erosion is none to slight except for cutting along streambanks. Available water capacity is high. Organic-matter content is high in the surface layer, and natural fertility is high. The soil is subject to flooding during heavy rain (fig. 12). In most areas, sediment accumulates from the floodwaters.

This soil is suited to row cropping if it is adequately protected from flooding and drained. Corn and soybeans are commonly grown.

This soil must be plowed when the moisture conditions are right or the surface layer dries and forms clods that are hard to break up when preparing a seedbed. Protecting from flooding, lowering the high water table, removing ponded surface water, maintaining a high level of fertility, and improving soil tilth are the main concerns in management. Small grain, grasses, and legumes are severely damaged by flooding; levees

Figure 12.—Area of Sloan silty clay loam along Brandywine Creek is flooded after heavy rain.

and diversions can be built to protect the soil from floodwaters. Surface drains, open ditches, and tiles can be used to remove excess water if adequate outlets are available. Some areas are underlain by water-bearing fine sand that can flow into the tiles and plug them. Green-manure crops can be used to improve soil tilth. If adequately drained and protected from flooding, the soil is well suited to intensive cropping. Because of the many concerns in management, many areas are left in permanent pasture.

CAPABILITY UNIT IVe-1

This unit consists of deep, well drained, medium textured and moderately fine textured, moderately sloping and strongly sloping soils. These soils formed in loamy glacial till on uplands. The moderately sloping soils are severely eroded, and the strongly sloping soils are eroded.

Runoff is medium to rapid, and the hazard of erosion is severe. Available water capacity is high. Organic-matter content is moderate in the surface layer, and the natural fertility is low.

These soils are suited to all crops commonly grown in the county. Small grain, grasses, and legumes are the main crops grown, but the soils are suited to occasional row crops of corn and soybeans.

The eroded soils are moderately easy to cultivate, but the severely eroded soils are hard to cultivate because the plow must turn over heavy clay subsoil material. Moisture conditions must be right or clods form that are hard to work into a suitable seedbed. Controlling erosion, improving soil tilth and fertility, and increasing organic-matter content are the main concerns in management. Farming on the contour, minimum tillage, terracing that has adequate outlets, and sod waterways are some practices that can be used to minimize soil loss through erosion. Proper use of crop residue increases organic-matter content and improves soil tilth. The soils are suited to small grain, grasses, and legumes for forage and occasional row crops of corn and beans. Many areas are used for grass and legume forage for livestock.

CAPABILITY UNIT VIe-1

Only soils in the Miami complex, 12 to 18 percent slopes, severely eroded, are in this unit. These are deep, well drained, medium textured and moderately fine textured, strongly sloping, severely eroded soils. These soils formed in loamy glacial till on uplands.

Runoff is rapid, and the hazard of erosion is severe. Available water capacity is high. Organic-matter content is moderate in the surface layer, and natural fertility is low.

These soils generally are not suited to row crops. Grasses, legumes, and occasional small grain are the common crops grown.

These soils are hard to cultivate because the plow must turn over heavy clay subsoil material. Moisture conditions must be right or clods form that are hard to work into a suitable seedbed. Controlling erosion, improving fertility, and maintaining organic-matter content and soil tilth are the main concerns in management. The soils are suited to grasses and legumes for forage. Most tree species produce well on the soils.

Predicted yields

Table 2 shows for each soil in the county, the average yields per acre of the principal crops grown under a high level of management.

The yields shown in table 2 are predicted averages for a period of 5 to 10 years. They are based on farm records; on interviews with farmers, members of the staff of the Purdue Agricultural Experiment Station, and area extension agents; and on direct observations by soil scientists and soil conservationists. Considered in making the predictions were the prevailing climate, the characteristics of the soils, and the influence of a high level of management on the soils.

The yield figures are not intended to apply directly to specific tracts of land for any particular year, because the soils differ somewhat from place to place, management practices differ from farm to farm, and weather conditions vary from year to year. Nevertheless, these estimates are useful in showing the relative productivity of soils under high-level management.

The predicted yields given in table 2 can be obtained by (1) using cropping systems that maintain tilth and organic-matter content, (2) controlling erosion to the maximum extent feasible, so that the quality of the soil is maintained or improved rather than reduced, (3) maintaining a high level of fertility by frequent soil tests and use of fertilizer and lime in accordance with the results of those tests, (4) using crop residue to the fullest extent practicable to protect and improve the soil, (5) keeping tillage to a minimum, (6) using only crop varieties that are best suited to the climate and the soil, (7) controlling weeds carefully by tillage and spraying, and (8) draining wet areas well enough so that wetness does not restrict yields of adapted crops.

Woodland[2]

The soils of Hancock County have been placed in woodland groups to assist in planning the use of soils for wood crops. Each group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management when their vegetation is similar, and that have about the same potential productivity.

Each woodland group is identified by a three-part symbol, such as 1o1, 3w5, or 5r14. The first part of the symbol, always a number, indicates relative potential productivity of the soils in the group: 1 indicates very high; 2, high; 3, moderately high; 4, moderate; and 5, low. These ratings are based on field determinations of average site index. Site index is the height, in feet, that the dominant trees of a given species, on a specified kind of soil, reach in a natural, unmanaged stand in a stated number of years. For the merchantable hardwoods and softwoods in this county, the site index is the height reached in 50 years.

The ratings for potential productivity are based on field determination of average site index of an indicator

[2] MITCHELL G. HASSLER, woodland conservationist, Soil Conservation Service, assisted in preparation of this section.

TABLE 2.—*Estimated average yields per acre of principal crops under high-level management*

Soil	Corn	Soybeans	Wheat	Legume-grass hay	Pasture
	Bu	*Bu*	*Bu*	*Tons*	*AUM* [1]
Brookston silty clay loam	145	51	65	5.5	11.0
Crosby silt loam, 0 to 3 percent slopes	115	40	50	4.0	8.0
Eel silt loam	120	42	48	4.0	8.0
Genesee silt loam	120	42	48	4.0	8.0
Kokomo silty clay loam	135	47	54	5.0	10.0
Martinsville loam, 0 to 2 percent slopes	120	42	48	4.0	8.0
Martinsville loam, 2 to 6 percent slopes, eroded	115	40	46	3.8	7.6
Miami silt loam, 0 to 2 percent slopes	110	38	50	4.5	9.0
Miami silt loam, 2 to 6 percent slopes, eroded	105	37	47	4.3	8.6
Miami silt loam, 6 to 12 percent slopes, eroded	95	33	43	4.0	8.0
Miami silt loam, 12 to 18 percent slopes, eroded	80	28	36	3.8	7.6
Miami complex, 6 to 12 percent slopes, severely eroded	90	32	40	3.5	7.0
Miami complex, 12 to 18 percent slopes, severely eroded			34	3.0	6.0
Milford silty clay loam	135	47	61	5.0	10.0
Ockley silt loam, 0 to 2 percent slopes	110	40	44	3.6	7.2
Ockley silt loam, 2 to 6 percent slopes, eroded	100	38	43	3.5	7.0
Ockley complex, 6 to 12 percent slopes, eroded	80	30	39	3.0	6.0
Palms muck	135	47	54	4.4	8.8
Rensselaer silty clay loam	150	53	60	5.5	11.0
Shoals silt loam	130	46	52	4.3	8.6
Sloan silty clay loam	140	49	56	4.6	9.2
Westland clay loam	140	49	56	4.6	9.2
Whitaker loam	130	46	52	4.8	9.6

[1] AUM stands for animal-unit-months, which is a term used to express the carrying capacity of pasture. It is the number of animals carried per acre multiplied by the number of months the pasture can be grazed during a single grazing season without injury to the sod. For example, the acre of pasture that provides 2 months of grazing for five cows has a carrying capacity of 10 animal-unit-months.

forest type or species. Site indexes are grouped into site quality classes, and the classes are used to arrive at approximate expected yields per acre in cords and board feet. On the basis of research studies, site index can be converted into approximate expected growth and yield per acre in cords and board feet. Conversions can be made by following the methods shown in USDA Technical Bulletin 560 (*6*) as adapted by Case, Gingrich, and Loyd in 1962 and Agricultural Handbook 181 (*8*) as adapted by Case in 1962.

The second part of the symbol identifying a woodland group is a small letter. This letter indicates an important soil property that imposes a slight to severe hazard or limitation in managing the soils of the group for wood crops. A letter *c* shows that the main limitation is the kind or amount of clay in the upper part of the soils; *o* shows that the soils have few limitations that restrict their use for trees; *r* shows that the main limitation is steep slopes; *s* shows that the soils are sandy and dry, have little or no difference in texture between surface layer and subsoil, have low available water capacity, and generally have a low supply of plant nutrients; *w* shows that water in or on the soil, either seasonally or year round, is the chief limitation.

The third part of the symbol is an identification number. Identification numbers are generally assigned locally but are part of a statewide system. All the units of the system are not represented in Hancock County; therefore, the woodland group numbers in this soil survey are not consecutive.

In table 3, each woodland group is rated according to the capabilities, limitations, and hazards of the soils for woodland use.

The hazards or limitations that affect management of soils for woodland are erosion hazard, equipment limitations, seedling mortality, windthrow hazard, and plant competition.

Erosion hazard refers to the potential hazard of soil losses in woodland. The hazard is *slight* if expected soil losses are small; *moderate* if some soil losses are expected and care is needed during logging and construction to reduce soil losses; *severe* if special methods of operation are necessary for preventing excessive soil losses. In Hancock County areas shown with a short steep slope symbol are subject to severe erosion.

Equipment limitations are rated on basis of soil characteristics that restrict or prohibit the use of equipment commonly used in tending and harvesting the trees. In Hancock County, soil characteristics having the most limiting effect are drainage, depth to the water table, slope, and texture of the surface layer. *Slight* means that there is no restriction in the kind of equipment or in the time of year it is used; *moderate* means that use of equipment is restricted for less than 3 months of the year; and *severe* means that special equipment is needed and its use is restricted for more than 3 months of the year.

TABLE 3.—*Suitability of*

[Dashed lines indicate that the species is not numerous enough on the soils of the given

Woodland group, description of soils, and map symbols	Potential productivity	
	Species	Site index
1o1: Deep, well drained, medium textured and moderately fine textured, nearly level to strongly sloping soils; high available water capacity; slow to rapid runoff. MaA, MaB2, MmA, MmB2, MmC2, MmD2, MpC3, MpD3, OcA, OcB2, OkC2.	Upland oaks Tulip-poplar Sweetgum	85–95 90–105 73–78
1o8: Deep, moderately well drained and well drained, medium textured, nearly level soils; high available water capacity; subject to seasonal flooding; slow runoff. Ee, Ge.	Tulip-poplar	95–105
2w11: Deep, very poorly drained, moderately fine textured, nearly level soils; high available water capacity; seasonal high water table; very slow runoff or ponded. Br, Ko, Mr, Re, So, We.	Pin oak Upland oak Sweetgum	80–90 70–80 85–95
2w13: Deep, somewhat poorly drained, medium textured, nearly level soils; high available water capacity; subject to seasonal flooding; seasonal high water table; slow runoff. Sh.	Tulip-poplar Sweetgum Pin oak Virginia pine	85–95 80–90 85–95 85–95
3w5: Deep, somewhat poorly drained, medium textured, nearly level soils; high available water capacity; seasonal high water table; slow runoff. CrA, Wh.	Tulip-poplar Upland oaks Pin oak Sweetgum	80–90 70–80 80–90 75–85
4w23: Deep, very poorly drained, nearly level muck soils; very high available water capacity; very slow runoff or ponded. Ps.	------	------

[1]These species can be used when the soil is drained.

Seedling mortality refers to the expected degree of mortality of planted seedlings as influenced by kinds of soil when plant competition is not a limiting factor. Considered in the ratings are depth to the water table, hazard of flooding, drainage, soil depth and structure, and degree of erosion. Normal rainfall, good planting stock, and proper planting are assumed. A rating of *slight* indicates an expected loss of less than 25 percent of the planted seedlings; *moderate*, a loss of 25 to 50 percent of the seedlings; and *severe*, a loss of more than 50 percent of the seedlings. Special preparation of the site is needed before planting for soils rated severe and for most soils rated moderate.

Windthrow hazard refers to the effect of the soils on root development and the ability of the soil to hold trees firmly. The hazard is *slight* if effective rooting is more than 20 inches and the tree withstands most wind; *moderate*, if effective rooting is from 10 to 20 inches and some trees are blown down during periods of excessive soil wetness and strong wind; and *severe*, if effective rooting is 10 inches or less and trees will not stand alone in strong wind.

Plant competition is rated on the basis of the degree to which unwanted plants invade openings in the tree canopy. Considered in the ratings are available water capacity, fertility, drainage, and degree of erosion. A rating of *slight* means that competition from other plants is not a concern; *moderate*, that plant competition delays development of fully stocked stands of desirable trees; and *severe*, that plant competition prevents establishment of a desirable stand unless intensive site preparation and such practices as weeding are used to control undesirable plants.

In table 3 the most desirable species to favor in natural stands and species suitable for planting are also listed.

Wildlife

This section provides information useful in planning, developing, and managing areas for wildlife. There are few direct relationships between the kinds of soil and the kinds of wildlife in an area. Therefore, this section deals with relationships between the kinds of soil and the kinds of plant and water developments that make up wildlife habitat.

Soil suitability is one of the important factors necessary to produce desired populations of wildlife. Proper manipulation of soil, water, and plants to produce suitable habitat is the most effective way to maintain and increase wildlife populations. Knowing the properties of soils makes it possible to predict how the soils will behave under various management practices. Thus, by using soil surveys, it is possible to make interpretations that are meaningful in wildlife management.

Each soil is rated in table 4 for its suitability for the improvement, maintenance, or creation of specific elements of wildlife habitat. Not considered in the rat-

the soils for woodland

group to be a major crop or that measurement of existing trees, if any, is not feasible]

Management hazards or limitations					Preferred species to—	
Erosion hazard	Equipment limitations	Seedling mortality	Windthrow hazard	Plant competition	Favor in existing stands	Use for planting
Slight to moderate.	Slight to moderate.	Slight	Slight	Moderate	Black walnut, tulip-poplar, red oak, white oak, white ash, sugar maple.	Black walnut, black locust, tulip-poplar, white ash, white pine, red pine.
Slight	Slight	Slight	Slight	Moderate	Black walnut, tulip-poplar, white ash, sycamore, cottonwood.	Black walnut, tulip-poplar, black locust, white pine.
Slight	Severe	Severe	Severe	Severe	White ash, pin oak, bur oak, red maple, sweetgum, white oak.	White ash, red maple, sweetgum, bald cypress, white pine, Norway spruce.
Slight	Slight	Slight	Slight	Severe	Tulip-poplar, pin oak, swamp chestnut oak, red maple, sweetgum.	White ash, red maple, sycamore, white pine, bald cypress, pin oak, tulip-poplar.
Slight	Slight	Slight	Slight	Moderate	Tulip-poplar, white ash, pin oak, bur oak, red maple, sweetgum, white oak, red oak.	Tulip-poplar, white ash, sycamore, red maple, white pine, bald cypress.
Slight	Severe	Severe	Severe	Severe		Northern white cedar, purple willow arborvitae, white pine, bush-honeysuckle, multiflora rose, Norway spruce[1].

TABLE 4.—*Suitability of the soils for elements of wildlife habitat and kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Open-land wildlife	Woodland wildlife	Wetland wildlife
Brookston: Br	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Crosby: CrA	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Eel: Ee	Poor	Fair	Fair	Good	Poor	Poor	Fair	Good	Poor.
Genesee: Ge	Poor	Fair	Fair	Good	Poor	Poor	Fair	Good	Poor.
Kokomo: Ko	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Martinsville: MaA, MaB2	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Miami:									
MmA, MmB2	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
MmC2, MpC3	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
MmD2, MpD3	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Milford: Mr	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ockley:									
OcA, OcB2	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
OkC2	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Palms: Ps	Very poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Rensselaer: Re	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Shoals: Sh	Poor	Fair	Fair	Good	Fair	Fair	Fair	Good	Fair.
Sloan: So	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Westland: We	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Whitaker: Wh	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.

ings are such factors as present land use, size and shape of soil areas, the pattern in which soils occur with other soils in the landscape, and existing wildlife populations and their ability to move from place to place, all of which require onsite investigation for their evaluation.

Soil characteristics that were evaluated to rate the soils are slope, permeability, thickness of soil useful to crops, surface texture, available water capacity, soil drainage, and flood hazard.

The ratings used in table 4 are good, fair, poor, and very poor. A rating of *good* indicates that habitats are easily improved, maintained, or created. There are few or no soil limitations in habitat management, and satisfactory results can be expected.

A rating of *fair* indicates that habitats can be improved, maintained, or created, but moderate soil limitations affect habitat management or development. A moderate intensity of management and fairly frequent attention may be required to ensure satisfactory results.

A rating of *poor* indicates that habitats can be improved, maintained, or created, but severe soil limitations affect habitat management or development. Habitat management may be difficult and expensive and require intensive effort. Results are questionable.

A rating of *very poor* indicates that under the prevailing soil conditions, it is impractical to attempt to improve, maintain, or create habitats. Unsatisfactory results are probable.

Grain and seed crops are domestic grain or seed-producing annuals that produce food for wildlife. Examples of these crops are corn, sorghum, wheat, oats, soybeans, millets, buckwheat and sunflowers.

Domestic grasses and legumes are perennial grasses and herbaceous legumes that are established by planting and that furnish wildlife cover and food. Examples of these crops are fescues, bromes, timothy, redtop, orchardgrass, reed canarygrass, clovers, trefoils, alfalfa, sericea lespedeza, and crown vetch.

Wild herbaceous plants are native or introduced perennial grasses and weeds that provide food and cover principally to upland forms of wildlife and are mainly established through natural processes. Examples of these plants are bluestem, wildrye, ragweed, lespedeza, goldenrod, and foxtail.

Hardwood trees are deciduous trees, shrubs, and woody vines that produce fruits, nuts, buds, and twigs of foliage used extensively as food by wildlife, and that commonly are established through natural processes but also may be planted. Examples are oaks, beech, cherries, hawthornes, dogwoods, maples, birches, poplars, blueberries, greenbriers, roses, and viburnums.

Wetland plants are annual and perennial wild herbaceous plants of moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover extensively used by wetland wildlife. Examples of these plants are smartweed, wild millets, bulrushes, sedges, reeds, cattails, and pondweeds.

Shallow water areas are impoundments or excavated areas that are used for the control of water, generally more than 5 feet deep. Examples of shallow water areas are low dikes and levees, shallow dugouts, level ditches, and devices for control of the water level in marshy streams and channels.

Table 4 also rates the soils according to their suitability for various kinds of wildlife based on the ratings for elements of wildlife habitat. These are briefly described in the following paragraphs.

Open-land wildlife consists of birds and mammals that normally frequent cropland, pasture, meadows, lawns, and areas overgrown with grasses, herbs, vines, and shrubby growth. Examples are quail, pheasant, cottontail rabbit, meadowlark, field sparrow, killdeer, red fox, and woodchuck.

Woodland wildlife consists of birds and mammals that normally frequent wooded areas of hardwood or coniferous trees and shrubs or a mixture of both. Examples are ruffed grouse, woodcock, thrushes, vireos, woodpeckers, gray squirrel, fox squirrel, gray fox, raccoon, and white-tailed deer.

Wetland wildlife consists of birds and mammals that frequent wet areas such as streams, ponds, ditches, marshes, and swamps. Examples are ducks, geese, herons, shore birds, rails, kingfishers, mink, and muskrat.

The ratings of soils for kinds of wildlife are made on the basis of weighed factors assigned to a selection of habitat elements appropriate to the kind of wildlife. For example, grain and seed crops, domestic grasses and legumes, and wild herbaceous plants are given greater weight than hardwood trees as habitat elements for open-land wildlife.

The ratings of soils for producing wildlife habitats provide an aid in the selection of sites for habitat management, an indication of management intensity needed to produce satisfactory results, and a means of grouping known soil conditions for broad-scale wildlife land use planning, for wildlife land acquisition, and for wildlife development. The ratings are an aid in showing landowners, in conjunction with soil maps of their property, places where management practices for desired wildlife are best applied and in helping them in their selection of practices. They can also be useful in showing why the landowner's desire for a particular species of wildlife may not be feasible.

Engineering Uses of the Soils[3]

This section is useful to those who need information about soils used as structural material or as foundations upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and limitations of soils for town and country planning.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 6 and 7, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for engineering.

Some of the terms used in this soil survey have different meanings in soil science than in engineering. The "Glossary" defines many of these terms as they are commonly used in soil science.

[3] EUGENE J. POPE, State conservation engineer, Soil Conservation Service, assisted in preparation of this section.

TABLE 5.—*Estimated soil proper*

[The symbol > means more than;

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Brookston: Br	0–1 or ponded	0–12	Silty clay loam	CL	A–6 or A–7	0
		12–54	Clay loam	CL or CH	A–6 or A–7	0
		54–60	Loam	CL	A–4 or A–6	0–3
Crosby: CrA	1–3	0–12	Silt loam	CL–ML or CL	A–4 or A–6	0
		12–40	Clay loam	CL	A–6 or A–7	0–2
		40–60	Loam	ML, CL–ML, or CL	A–4 or A–6	0–3
Eel: Ee	2–4	0–12	Silt loam	CL or CL–ML	A–4 or A–6	0
		12–39	Silt loam, loam, clay loam	CL or ML	A–4 or A–6	0
		39–60	Sand, sandy loam	SM, SM–SC	A–2–4, A–4, or A–6	0
Genesee: Ge	>4	0–12	Silt loam	CL or ML	A–4 or A–6	0
		12–54	Silt loam, loam	CL or ML	A–4 or A–6	0
		54–60	Sandy loam, loamy sand	SM, SM–SC	A–2–4, A–4	0
Kokomo: Ko	0–1 or ponded	0–11	Silty clay loam	CL or CH	A–7 or A–6	0
		11–44	Silty clay loam, clay loam	CL or CH	A–6 or A–7	0
		44–60	Loam	CL	A–4 or A–6	0–3
Martinsville: MaA, MaB2	>4	0–13	Loam	CL, CL–ML	A–4 or A–6	0
		13–54	Clay loam, sandy clay loam, sandy loam.	CL, CL–ML, or SM–SC	A–4, A–2, or A–6	0
		54–60	Sand and silt loam	SM–SC or SC	A–4 or A–2–4	0
Miami:						
MmA, MmB2, MmC2, MmD2	>4	0–6	Silt loam	CL, CL–ML, or CL	A–4 or A–6	0
		6–33	Clay loam	CL	A–6 or A–7	0
		33–60	Loam	ML, CL–ML, or CL	A–4 or A–6	0–3
MpC3, MpD3	>4	0–6	Clay loam	CL	A–6 or A–7	0
		6–23	Clay loam	CL	A–6 or A–7	0
		23–60	Loam	ML, CL–ML, or CL	A–4 or A–6	0–3
Milford: Mr	0–1 or ponded	0–9	Silty clay loam	CL or CH	A–7	0
		9–40	Silty clay and silty clay loam.	CL or CH	A–7	0
		40–60	Silty clay loam, silt loam	CL	A–7 or A–6	0
Ockley: OcA, OcB2, OkC2	>4	0–13	Silt loam, loam	CL or CL–ML	A–4 or A–6	0
		13–21	Clay loam	CL	A–4 or A–6	0
		21–49	Gravelly clay loam	CL or SC	A–6 or A–7	0–2
		49–60	Gravelly sand	SP, SP–SM, GP, or GP–GM	A–1–b	1–5
Palms: Ps	0–1 or ponded	0–30	Muck	Pt		0
		30–45	Loam	CL–ML or CL	A–4 or A–6	0–3
		45–60	Gravelly loamy sand	SP–SM or SM	A–1–b or A–2	0–5
Rensselaer: Re	0–1 or ponded	0–11	Silty clay loam	CL or CH	A–6 or A–7	0
		11–42	Clay loam, silty clay loam	CL	A–6 or A–7	0
		42–60	Silt loam, sandy loam, clay loam, and sand.	CL–ML, CL, SM–SC, or SC	A–4	0
Shoals: Sh	1–3	0–11	Silt loam	CL or CL–ML	A–4 or A–6	0
		11–60	Loam, silt loam, clay loam, and sandy loam.	ML	A–4	0–3
Sloan: So	0–1 or ponded	0–13	Silty clay loam	ML or CL	A–4, A–5, A–6, or A–7	0
		13–34	Clay loam, loam	ML or CL	A–6 or A–7	0
		34–60	Sandy loam, loam, loamy sand.	CL–ML or CL	A–4 or A–6	0

ties significant to engineering

the symbol < means less than]

Percentage passing sieve— No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Liquid limit	Plasticity index	Perme-ability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
						In per hour	*In per in of soil*	*pH*		
100	98–100	95–100	75–95	36–48	15–20	0.6–2.0	0.21–0.23	6.1–7.3	High	Moderate.
98–100	96–100	85–95	75–85	36–52	18–30	0.6–2.0	0.15–0.19	6.1–7.8		Moderate.
90–100	85–95	78–90	55–70	22–30	7–15	0.2–0.6	0.05–0.19	7.4–8.4		Moderate.
100	95–100	80–100	50–90	22–34	6–15	0.6–2.0	0.22–0.24	5.6–6.5	High	Low.
92–99	90–97	78–90	65–75	37–50	17–31	0.06–0.2	0.15–0.19	5.1–7.8		Moderate.
90–94	85–89	75–87	50–64	17–30	2–14	0.06–0.2	0.05–0.19	7.9–8.4		Low.
100	100	90–100	75–85	26–36	6–15	0.6–2.0	0.22–0.24	6.1–7.3	High	Low.
100	100	90–100	75–85	26–40	5–15	0.6–2.0	0.17–0.21	6.6–7.3		Low.
100	90–100	50–70	10–40	15–25	[1]NP–5	0.6–2.0	0.05–0.13	6.6–8.4		Low.
100	100	90–100	75–85	26–36	6–15	0.6–2.0	0.22–0.24	6.1–7.8	Moderate	Low.
100	100	90–100	75–85	26–40	5–15	0.6–2.0	0.17–0.21	6.6–8.4		Low.
100	90–100	50–70	10–40	15–25	NP–5	0.6–2.0	0.05–0.13	6.6–8.4		Low.
100	98–100	85–95	75–85	35–55	15–30	0.6–2.0	0.21–0.23	6.1–7.3	High	Moderate.
98–100	98–100	95–100	75–95	38–55	15–30	0.06–0.2	0.18–0.20	6.1–8.4		Moderate.
90–100	85–95	75–90	55–70	25–35	10–20	0.06–0.2	0.05–0.19	7.9–8.4		Low.
100	95–100	80–100	60–85	22–33	4–12	0.6–2.0	0.20–0.22	5.1–6.5	Moderate	Low.
100	95–100	65–90	30–80	20–35	6–17	0.6–2.0	0.15–0.19	5.1–7.8		Low.
98–100	95–100	50–90	10–50	15–25	4–9	2.0–6.0	0.19–0.21	7.4–8.4		Low.
100	95–100	85–100	50–90	23–34	6–15	0.6–2.0	0.22–0.24	5.6–7.3	Moderate	Low.
92–99	90–97	80–95	65–95	37–50	17–31	0.6–2.0	0.15–0.19	5.1–7.8		Moderate.
90–94	85–90	75–85	50–64	17–30	2–14	0.2–0.6	0.05–0.19	7.9–8.4		Low.
95–100	90–100	80–100	65–85	35–50	15–30	0.6–2.0	0.22–0.24	5.6–7.3	Moderate	Low.
92–99	90–97	80–95	65–95	37–50	17–31	0.6–2.0	0.15–0.19	5.1–7.8		Moderate.
90–94	85–90	75–85	50–64	17–30	2–14	0.2–0.6	0.05–0.19	7.8–8.4		Low.
100	100	95–99	90–99	42–58	19–32	0.2–0.6	0.21–0.23	6.1–7.3	High	High.
100	100	95–99	85–99	41–61	23–38	0.2–0.6	0.12–0.18	6.6–8.4		High.
100	98–100	90–99	70–99	34–50	15–31	0.2–0.6	0.15–0.20	7.4–8.4		Moderate.
100	95–100	80–100	60–90	22–33	4–12	0.6–2.0	0.22–0.24	5.6–7.3	Moderate	Low.
100	75–100	65–90	50–90	20–35	8–17	0.6–2.0	0.15–0.20	5.1–6.5		Moderate.
70–85	45–75	40–70	35–55	30–45	11–25	0.6–2.0	0.12–0.14	5.6–6.5		Moderate.
30–70	25–55	7–20	2–10	<2	0	>20	0.02–0.04	7.9–8.4		Low.
						>20	>0.35–0.45	5.1–8.4	High	High.
95–100	95–100	80–95	55–75	12–30	6–12	0.2–2.0	0.17–0.19	6.1–8.4		Low.
70–75	65–75	35–55	10–25	<5	NP	0.2–2.0	0.05–0.07	6.1–8.4		Low.
100	100	95–100	85–95	40–54	20–32	0.2–0.6	0.21–0.23	6.1–7.3	High	Moderate.
100	100	90–100	70–80	33–47	15–26	0.06–0.2	0.15–0.19	6.1–7.8		Moderate.
98–100	98–100	95–100	40–60	<30	4–9	0.06–0.2	0.19–0.21	7.4–8.4		Low.
100	100	90–100	65–90	22–36	6–15	0.6–2.0	0.22–0.24	6.1–7.3	High	Low.
95–100	90–100	70–80	55–70	32–40	3–8	0.6–2.0	0.19–0.21	6.6–8.4		Low.
100	100	90–100	85–95	30–45	8–15	0.6–2.0	0.21–0.23	6.1–7.8	High	Moderate.
100	90–100	85–95	75–95	30–45	11–18	0.6–2.0	0.17–0.19	6.6–7.8		Moderate.
95–100	90–100	80–95	65–90	25–35	6–15	0.6–2.0	0.08–0.13	6.6–8.4		Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification: Unified	Classification: AASHTO	Coarse fraction greater than 3 inches
	Ft	*In*				*Pct*
Westland: We	0–1 or ponded	0–11	Clay loam	CL	A–6	0
		11–32	Clay loam, silty clay loam	CL	A–6	0
		32–48	Gravelly clay loam, gravelly loam.	CL	A–6	0–3
		48–60	Very gravelly loamy sand	GP, GP–GM, SP, or SP–SM	A–1–b	1–5
Whitaker: Wh	1–3	0–11	Loam	CL or CL–ML	A–4 or A–6	0
		11–56	Clay loam, sandy clay loam, loam, and sandy loam.	CL or SC	A–6 or A–7	0
		56–60	Sandy loam, loamy sand, and sand.	CL, ML, CL–ML, or SM–SC	A–4	0

[1]NP = Nonplastic.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—: Topsoil	Suitability as source of—: Sand and gravel	Suitability as source of—: Road fill	Soil features affecting—: Embankments, dikes, and levees
Brookston: Br	Poor: very poorly drained.	Unsuited	Poor: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action.	Medium to low shear strength; medium to high compressibility; low permeability of compacted soil; fair compaction characteristics.
Crosby: CrA	Fair: 8 to 14 inches of suitable material.	Unsuited	Poor: high potential frost action; fair to poor compaction characteristics and stability; fair to poor shear strength.	Medium to low shear strength; medium compressibility; low permeability of compacted soil; good to fair compaction characteristics.
Eel: Ee	Good	Unsuited[1]	Poor: high potential frost action; fair compaction characteristics and stability; fair to poor shear strength.	Medium to low shear strength; medium compressibility; low to medium permeability of compacted soil; poor to good compaction characteristics.
Genesee: Ge	Good	Unsuited[1]	Fair: moderate potential frost action; fair to poor shear strength; fair compaction characteristics and stability.	Medium to low shear strength; medium compressibility; low to medium permeability of compacted soil; poor to good compaction characteristics.
Kokomo: Ko	Poor: very poorly drained.	Unsuited	Poor: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action.	Medium to low shear strength; medium to high compressibility; low permeability of compacted soil; fair to poor compaction characteristics.
Martinsville: MaA, MaB2.	Fair: 6 to 15 inches of suitable material.	Unsuited for gravel; sand below a depth of 60 inches in some places.	Fair: moderate potential frost action; fair to poor shear strength and compaction characteristics; fair stability.	Medium to low shear strength; low to medium compressibility; medium to low permeability of compacted soil; fair to good compaction characteristics.
Miami: MmA, MmB2, MmC2, MmD2, MpC3, MpD3.	Fair where slopes are 0 12 percent: 6 to 12 inches of suitable material. Poor where slopes are 12 to 18 percent: hazard of erosion.	Unsuited	Fair: moderate frost action; fair to poor shear strength and compaction characteristics; fair to poor stability.	Medium to low shear strength; medium compressibility; low permeability of compacted soil; fair compaction characteristics.

significant to engineering—Continued

Percentage passing sieve—				Liquid limit	Plasticity index	Perme-ability	Available water capacity	Reaction	Potential frost action	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
						In per hour	*In per in of soil*	*pH*		
95–100	90–100	85–95	65–75	27–38	11–20	0.6–2.0	0.18–0.21	6.1–7.3	High	Moderate.
95–100	90–100	80–90	65–75	30–40	20–30	0.06–0.2	0.16–0.19	6.1–7.3		Moderate.
65–75	60–70	55–70	50–70	30–40	20–30	0.06–0.2	0.10–0.12	6.1–8.4		Moderate.
40–70	25–55	10–20	2–10	0	NP	>20	0.02–0.04	7.9–8.4		Low.
100	95–100	85–100	60–90	22–33	4–12	0.6–2.0	0.20–0.22	5.6–7.3	High	Low.
98–100	95–100	50–85	40–60	30–47	12–26	0.6–2.0	0.15–0.18	5.1–8.4		Moderate.
98–100	95–100	90–100	35–60	15–21	4–9	0.6–2.0	0.05–0.07	7.9–8.4		Low.

interpretations of the soils

Soil features affecting—Cont.			
Pond reservoir areas	Drainage for crops and pasture	Terraces and diversions	Grassed waterways
Seasonal high water table at a depth of 0 to 1 foot, or ponded; underlying material has moderately slow permeability; suitable for pit-type ponds.	Underlying material has moderately slow permeability; depressional; very poorly drained; runoff very slow or ponded.	Not needed; depressional; runoff very slow or ponded.	Generally not needed; depressional; very poorly drained.
Seasonal high water table at a depth of 1 foot to 3 feet; slow permeability; most areas suitable for pit-type ponds.	Somewhat poorly drained; slow permeability.	Generally not needed; runoff slow; features are favorable.	Generally not needed; features are favorable; moderately erodible.
Seasonal high water table at a depth of 2 to 4 feet; underlain by sand and gravel; not suitable in most areas.	Moderately well drained; moderate permeability; subject to occasional flooding.	Generally not needed; nearly level; runoff slow.	Generally not needed; nearly level; runoff slow.
Moderate permeability; deep to water table; underlain by sand and gravel; seepage.	Well drained; moderate permeability; subject to occasional flooding.	Generally not needed; nearly level; runoff slow.	Generally not needed; nearly level; runoff slow.
Seasonal high water table at a depth of 0 to 1 foot, or ponded; slow permeability; suitable for pit-type ponds.	Very poorly drained; slow permeability; runoff very slow or ponded.	Not needed; depressional; runoff very slow or ponded; very poorly drained.	Not needed; depressional; runoff very slow or ponded; very poorly drained.
Moderate permeability; deep to water table; underlain by permeable sand; seepage.	Well drained.	Generally not needed; slopes are generally short; runoff slow or medium; features favorable.	Features are favorable.
Moderately slow permeability; deep to water table; slope hinders pit-type ponds; some areas where slopes are 6 to 18 percent are suitable for pit-type ponds.	Well drained; small seeps in some places; on severely eroded areas the clay loam surface layer does not dry as fast.	Features are favorable where slopes are 0 to 2 percent: generally not needed. Moderate erosion hazard where slopes are 2 to 12 percent. Unsuitable where slopes are 12 to 18 percent.	Features are favorable; slopes of more than 6 percent erode easily; runoff medium to rapid.

TABLE 6.—*Engineering interpretations*

Soil series and map symbols	Suitability as source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Embankments, dikes, and levees
Milford: Mr	Poor: very poorly drained.	Unsuited	Poor: poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; high shrink-swell.	Medium to low shear strength; medium to high compressibility; low permeability of compacted soil; fair compaction characteristics.
Ockley: OcA, OcB2, OkC2.	Fair: 8 to 13 inches of suitable material.	Good	Fair: moderate frost action; fair shear strength; good to fair compaction characteristics; fair stability.	Surface layer and subsoil have medium to low shear strength and compressibility; medium to low permeability of compacted soil; and fair compaction characteristics. Underlying material has high shear strength; low compressibility; high permeability of compacted soil; and good compaction characteristics.
Palms: Ps	Poor: very poorly drained.	Unsuited[1]	Poor: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; organic material unstable.	Muck is unsuited. Underlying material has medium to low shear strength; medium compressibility; medium to low permeability of compacted soil; and fair compaction characteristics.
Rensselaer: Re	Poor: very poorly drained.	Unsuited[1]	Poor: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; fair to poor shear strength and compaction characteristics.	Medium to low shear strength; medium compressibility; medium to low permeability of compacted soil; fair to good compaction characteristics; moderate shrink-swell.
Shoals: Sh	Good	Unsuited[1]	Poor: high potential frost action; fair to good shear strength and compaction characteristics; medium to high compressibility.	Medium to low shear strength; medium compressibility; low to medium permeability of compacted soil; poor to good compaction characteristics.
Sloan: So	Poor: very poorly drained.	Unsuited[1]	Poor: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; fair shear strength; good to fair compaction characteristics; fair stability.	Medium to low shear strength; medium compressibility; medium to low permeability of compacted soil; fair to good compaction characteristics.
Westland: We	Poor: very poorly drained.	Good	Poor: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; fair to poor shear strength and compaction characteristics; fair stability.	Surface layer and subsoil have medium to low shear strength; medium to low compressibility; low permeability of compacted soil; and fair compaction characteristics. Underlying material has high shear strength; low compressibility; high permeability of compacted soil; and good compaction characteristics.
Whitaker: Wh	Good	Poor	Poor: high potential frost action; fair to poor shear strength and compaction characteristics; fair to poor stability.	Medium to low shear strength; medium compressibility; medium to low permeability of compacted soil; fair to good compaction characteristics.

[1]These soils are underlain by sand and gravel at a depth below 5 feet in some areas.

of the soils—Continued

Soil features affecting—Cont.			
Pond reservoir areas	Drainage for crops and pasture	Terraces and diversions	Grassed waterways
Moderately slow permeability; seasonal high water table at a depth of 0 to 1 foot, or ponded; suitable for pit-type ponds.	Poorly drained; moderately slow permeability; runoff very slow or ponded.	Not needed; depressional; runoff very slow or ponded; poorly drained.	Not needed; depressional; runoff very slow or ponded; poorly drained.
Moderate permeability; deep to water table; underlain by sand and gravel; seepage.	Well drained.	Features are favorable where slopes are 0 to 12 percent: generally not needed; gravelly subsoil.	Features are favorable where slopes are 0 to 12 percent: generally not needed; runoff moderate to rapid; erodes easily.
Seasonal high water table at a depth of 0 to 1 foot, or ponded; most areas are suited to pit-type ponds where water table remains high throughout the year.	Very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; organic material unstable; generally poor outlets.	Not needed; depressional; very poorly drained.	Not needed; depressional; very poorly drained.
Seasonal high water table at a depth of 0 to 1 foot, or ponded; moderately slow permeability; some undrained areas are suitable for pit-type ponds where water table remains high throughout the year.	Very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderately slow permeability; sand and silt below a depth of 4 feet need special attention.	Not needed; depressional; very poorly drained.	Not needed; depressional very poorly drained.
Seasonal high water table at a depth of 1 foot to 3 feet; subject to occasional flooding.	Somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; subject to occasional flooding; sand and silt below a depth of 4 feet need special attention.	Not needed; features are favorable.	Generally not needed; features are favorable.
Seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate permeability; subject to flooding; undrained areas are suitable for pit-type ponds where the water table remains high throughout the year.	Very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; subject to flooding; sand and silt below a depth of 4 feet need special attention; usually poor outlets.	Generally not needed; depressional; very poorly drained.	Generally not needed; depressional; very poorly drained.
Seasonal high water table at a depth of 0 to 1 foot, or ponded; moderately slow permeability; underlain by sand and gravel; most undrained areas are suitable for pit-type ponds.	Very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderately slow permeability; sand and gravel below a depth of 4 feet need special attention.	Generally not needed; depressional; very poorly drained.	Generally not needed; depressional; very poorly drained.
Seasonal high water table at a depth of 1 foot to 3 feet; moderate permeability; underlain by sand; seepage.	Somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; moderate permeability; silt and sand below a depth of 4 feet need special attention.	Features are favorable; generally not needed.	Features are favorable; generally not needed.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Dwellings with basements	Dwellings without basements	Commercial or light industrial developments	Landscaping and lawns
Brookston: Br	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate shrink-swell.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate shrink-swell; high potential frost action.	Severe if undrained: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate if artificially drained.
Crosby: CrA	Severe: somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet.	Moderate: somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; moderate to low shrink-swell; high potential frost action.	Moderate: somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; moderate to low shrink-swell; high potential frost action.	Slight.
Eel: Ee	Severe: subject to occasional flooding.	Severe: subject to occasional flooding; moderate potential frost action.	Severe: subject to occasional flooding; moderate potential frost action.	Slight: subject to occasional flooding.
Genesee: Ge	Severe: subject to occasional flooding.	Severe: subject to occasional flooding; moderate potential frost action.	Severe: subject to occasional flooding; moderate potential frost action.	Slight: subject to occasional flooding.
Kokomo: Ko	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate shrink-swell.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate shrink-swell.	Severe if undrained: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate if artifically drained.
Martinsville: MaA, MaB2.	Slight.	Slight.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent: slope hinders development.	Slight.
Miami: MmA, MmB2, MmC2, MmD2, MpC3, MpD3.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders development. Severe where slopes are 12 to 18 percent: slope hinders development.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders development. Severe where slopes are 12 to 18 percent: slope hinders development.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent: slope hinders development. Severe where slopes are 6 to 18 percent: slope hinders development.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: hazard of erosion; slope hinders development and maintenance. Severe where slopes are 12 to 18 percent: hazard of erosion; slope hinders development.
Milford: Mr	Severe: poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; high shrink-swell.	Severe: poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; high shrink-swell.	Severe if undrained: poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate if artificially drained.
Ockley: OcA, OcB2, OkC2.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders development.	Moderate: moderate shrink-swell.	Moderate where slopes are 0 to 6 percent: moderate shrink-swell. Severe where slopes are 6 to 12 percent: slope hinders development.	Slight.
Palms: Ps	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; unstable organic material; high compressibility.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; unstable organic material; high compressibility.	Severe- very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; unstable organic material; high compressibility.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.

for town and country planning

Local roads, streets, and parking lots	Septic tank absorption fields	Sewage lagoons	Sanitary landfill (trench type)
Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate shrink-swell; high potential frost action.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate permeability.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.[1]	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.
Severe: high potential frost action; somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; moderate to low shrink-swell.	Severe: slow permeability; somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet.	Slight.	Moderate: somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; clay loam texture moderately affects workability.
Severe: subject to occasional flooding; moderate potential frost action.	Severe: subject to occasional flooding.	Severe: subject to occasional flooding; permeable stratified sand at a depth of less than 5 feet; severe hazard of effluent seepage to ground water.	Severe: subject to occasional flooding; permeable stratified sand at a depth of less than 5 feet; severe hazard of leachate flow to ground water.
Severe: subject to occasional flooding; moderate potential frost action.	Severe: subject to occasional flooding.	Severe: subject to occasional flooding; permeable stratified sand at a depth of less than 5 feet; severe hazard of effluent seepage to ground water.	Severe: subject to occasional flooding; permeable stratified sand at a depth of less than 5 feet; severe hazard of leachate flow to ground water.
Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate shrink-swell.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; slow permeability.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.[1]	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; silty clay texture severely affects workability.
Moderate: moderate potential frost action; moderate to low shrink-swell.	Slight.	Severe: permeable stratified sand at a depth of less than 5 feet; severe hazard of effluent seepage to ground water.	Severe: permeable stratified sand at a depth of less than 5 feet; hazard of leachate flow to ground water.
Moderate where slopes are 0 to 12 percent: moderate potential frost action. Severe where slopes are 12 to 18 percent: slope hinders development.	Moderate where slopes are 0 to 12 percent: moderately slow permeability; slope causes moderate hazard of effluent seepage. Severe where slopes are 12 to 18 percent: severe hazard of erosion and effluent seepage.	Moderate where slopes are 0 to 6 percent: moderate hazard of effluent seepage; slopes of 2 to 6 percent moderately hinder development. Severe where slopes are 6 to 18 percent: slope severely hinders development.	Slight where slopes are 0 to 12 percent. Moderate where slopes are 12 to 18 percent: slope moderately hinders development.
Severe: poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; high shrink-swell.	Severe: moderately slow permeability; poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.[1]	Severe: poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; silty clay texture severely affects workability.
Moderate: moderate potential frost action; moderate shrink-swell.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope causes moderate hazard of effluent seepage.	Severe: less than 5 feet deep to rapidly permeable sand and gravel; severe hazard of effluent seepage to ground water.	Severe: less than 5 feet deep to rapidly permeable sand and gravel; severe hazard of leachate flow to ground water.
Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; unstable organic material; high compressibility; high potential frost action.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; organic material promotes undesirable aquatic growth.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; organic material does not provide satisfactory cover.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Dwellings with basements	Dwellings without basements	Commercial or light industrial developments	Landscaping and lawns
Rensselaer: Re	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe if undrained: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate if artificially drained.
Shoals: Sh	Severe: subject to occasional flooding; somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet.	Severe: subject to occasional flooding; somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet.	Severe: subject to occasional flooding; somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet.	Severe: subject to occasional flooding.
Sloan: So	Severe: subject to occasional flooding; very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: subject to occasional flooding; very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe: subject to occasional flooding; very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe: subject to occasional flooding; very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.
Westland: We	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe if undrained: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderate if artificially drained.
Whitaker: Wh	Severe: somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet.	Moderate: somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; high potential frost action; moderate to low shrink-swell.	Moderate: somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; high potential frost action; moderate to low shrink-swell.	Slight.

[1]If floor of the lagoon is nearly impermeable material at least 2 feet thick, depth to water table can be disregarded.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*2*) used by the SCS engineers, Department of Defense, and others, and the AASHTO system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system is used to classify soils according to engineering uses for building material or for the support of structures other than highways. Soils are classified according to particle size distribution, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes. Eight classes of coarse-grained soils are subdivided on the basis of gravel and sand content. These are identified as GW, GP, GM, GC, SW, SP, SM, and SC. Six classes of fine-grained soils are subdivided on the basis of the plasticity index. Nonplastic classes are ML, MH, OL, and OH; plastic classes are CL and CH. One class of highly organic soils is identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, the clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The estimated AASHTO classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

Soil properties significant in engineering

Several estimates of soil properties significant in engineering are given in table 5. Evaluations are made *for town and country planning*—Continued

Local roads, streets, and parking lots	Septic tank absorption fields	Sewage lagoons	Sanitary landfill (trench type)
Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderately slow permeability.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; permeable stratified sand at a depth of less than 5 feet; severe hazard of effluent seepage to ground water.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; permeable stratified sand at a depth of less than 5 feet; severe hazard leachate flow to ground water.
Severe: subject to occasional flooding; somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; high potential frost action.	Severe: subject to occasional flooding; somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet.	Severe: subject to occasional flooding; permeable stratified sand at a depth of less than 5 feet; severe hazard of effluent seepage to ground water.	Severe: subject to occasional flooding; permeable stratified sand at a depth of less than 5 feet; severe hazard of leachate flow to ground water.
Severe: subject to occasional flooding; very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe: subject to occasional flooding; very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: subject to occasional flooding; very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.	Severe: subject to occasional flooding; very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded.
Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; high potential frost action; moderate to low shrink-swell.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; moderately slow permeability.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; rapidly permeable sand and gravel at a depth of less than 5 feet; severe hazard of effluent seepage to ground water.	Severe: very poorly drained; seasonal high water table at a depth of 0 to 1 foot, or ponded; rapidly permeable sand and gravel at a depth of less than 5 feet; severe hazard of leachate flow to ground water.
Severe: high potential frost action; somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; moderate to low shrink-swell.	Severe: somewhat poorly drained; seasonal high water table at a depth of 1 foot to 3 feet; moderate permeability.	Severe: permeable stratified sand at a depth of less than 5 feet; severe hazard of effluent seepage to ground water.	Severe: permeable stratified sand at a depth of less than 5 feet; severe hazard of leachate flow to ground water.

for the typical profile of each soil series by layers sufficiently different from each other to have unique significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for the specified soils and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Depth to seasonal high water table is distance from the surface of the soil downward to the highest level reached in most years by ground water.

Depth from surface is given in inches for major horizons or for special horizons that have engineering properties significantly different from those of adjacent horizons.

Dominant USDA texture is described in the standard terms used by the United States Department of Agriculture (USDA). These terms are based on the percentages of sand, silt, and clay in the less than 2 millimeter fraction of the soil. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the "Glossary." Also listed are the Unified and the AASHTO classification for the soils.

Percentage passing sieve shows percentages of material that pass through the No. 4 (4.7 millimeters), No. 10 (2.0 millimeters), No. 40 (0.42 millimeters), and No. 200 (0.074 millimeter) sieves and thus indicates the grain-size distribution in a soil.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the water content of a clayey soil, from which the particles coarser than 0.42 millimeter have been removed, is increased from a dry state, the material changes from a semisolid to a plastic. If the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic; and the liquid limit, from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of water content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5.

Permeablity is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure, porosity, and texture. Lateral seepage or such transient soil features as plowpans and surface crusts are not considered.

Available water capacity is an estimate of the capacity of soils to hold water for use by most plants. It is defined here as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the "Glossary."

Potential frost action is the likelihood of upward or lateral expansion of soil because of the formation of segregated ice lenses and the subsequent loss of strength and collapse on thawing. These probable affects are important mainly in selecting sites for highways and runways but also are important in planning any structure that is to be supported or abutted by soil that freezes. Ratings given are high, medium, and low and refer to the probability of damage.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soil causes much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Engineering interpretations of the soils

The interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Hancock County. In table 6, ratings of good, fair, and poor are used to summarize suitability of the soils for topsoil, sand and gravel, and road fill. For all other uses, table 6 lists those soil features not to be overlooked in planning, installation, and maintenance.

Following are explanations of the columns in table 6.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material; or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments affect suitability, but also considered in the ratings is damage that results at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 6 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are unfavorable factors.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope, stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or ridges constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Grassed waterways are vegetated, shallow but broad, channels which receive runoff water and carry it safely downslope to existing streams or water courses. Features that affect construction are slope, runoff, texture, permeability, resistance to water erosion, and features that affect the establishment and growth of plants.

Town and Country Planning

Residential, commercial, industrial, and institutional developments are growing in Hancock County as the suburbs of towns expand into the rural areas. The rapidity with which developments have expanded in the past has led to many problems that clearly show the need for careful planning and for broad understanding of the physical and economic aspects involved when the use of land is changed.

This soil survey helps in planning these developments and in solving problems that arise as use of the land changes. The limitations of the soils in Hancock County for some uses in town and country planning are given in table 7. This information can be used, along with information in table 8 and in other parts of the survey, as a guide in the use of soils for town and country planning. Before any construction begins, however, an investigation should be made at the site being considered. The evaluations in table 7 apply only to a depth of 5 feet or less. Soils are rated on the basis of three classes of soil limitations. A rating of slight means that for the intended use the soil is relatively free of limitations and the facility is easily created, improved, or maintained. A rating of *moderate* means that limitations need to be recognized but can be overcome with good management and careful design. A *severe* rating means that limitations are severe enough to make use questionable and extreme measures are needed to overcome limitations.

In the paragraphs that follow, town and country planning uses are defined and the properties important in rating the limitations for such purposes are given.

Dwellings with basements.—Interpretations are for undisturbed soils that are evaluated to a depth of 5 feet for single-family dwellings and other structures with similar foundation requirements. Excluded are buildings of more than three stories and other buildings with foundation loads in excess of those equal to three-story dwellings. The emphasis for rating is on the cost of excavation, the bearing strength of the foundation, and the drainage around the basement. A properly constructed basement not only supports the building without undue settling and cracking, but also is dry throughout the year. Sound construction techniques should provide adequate drainage around the foundation or footing to prevent undue settling and wetness. Also considered are factors that influence installation of utility lines, such as those between the dwellings and the trunklines. Soil characteristics affect construction of dwellings include drainage, seasonal high water table, flooding hazard, slope, shrink-swell potential, texture, potential frost action, and depth to bedrock. Onsite investigations are needed for specific placement of buildings and utility lines and for detailed design of foundations.

Dwellings without basements.—Interpretations are for undisturbed soils that are evaluated to a depth of 5 feet for single-family dwellings and other structures with similar foundation requirements. Excluded are buildings of more than three stories and other buildings with foundation loads in excess of those equal to three-story dwellings. The emphasis for rating is on the bearing strength of the foundation. A properly constructed foundation should support the building without undue settling and cracking. Sound construction techniques should provide adequate drainage around the foundation or footing to prevent undue settling and wetness. Also considered are factors that influence installation of utility lines, such as those between the dwellings and the trunklines. Soil characteristics affecting construction of dwellings include drainage, seasonal high water table, flooding hazard, slope, shrink-swell potential, texture, potential frost action, and depth to bedrock. Onsite investigations are needed for specific placement of buildings and utility lines and for detailed design of foundations.

Commercial or light industrial developments.—Interpretations are for shipping centers and small industrial buildings with foundation requirements not exceeding those of ordinary three-story dwellings. The cost of excavation, the bearing strength of the foundation, and the drainage depend upon the soil. Sound construction techniques should provide adequate drainage around the foundation or footing to prevent undue settlement. Soil characteristics affecting industrial or commercial sites include drainage, depth to seasonal high water table, flooding hazard, slope, shrink-swell potential, texture, potential frost action, and depth to bedrock. In determining the degree of limitations for commercial or industrial developments, soil characteristics used to rate soils for septic tank absorption fields, landscaping and lawns, and roads and streets were not considered. Such interpretations are provided in other columns in this table. Onsite investigations are needed for specific placement of buildings and utility lines and for detailed design of foundations.

Landscaping and lawns.—The establishment of lawns and shrubs is important in most residential areas and around many commercial locations. Some soil characteristics which are limited for landscaping and lawns may not be limited for building purposes. Some landscaping problems can be overcome or dealt with if the soil problems are understood. The soil characteristics affecting the establishment and maintenance of lawns and shrubs are slope, drainage, depth to seasonal high water table, flooding and ponding hazard, available water capacity, surface layer texture, erosion hazard, and depth to root restricting layer.

Local roads, streets, and parking lots.—These interpretations are for areas that carry automobile traffic all year. The interpretations consider the underlying soil material, either cut or fill, called the road subgrade; the base material of gravel, crushed rock, or lime—or cement-stabilized soil called the surface; and the actual road surface, generally asphalt or concrete, called the pavement. It is assumed in this interpretation that the subgrade for roads, streets, and parking lots is built mainly from the soil at hand and cuts and fills are limited generally to less than 6 feet. Soil characteristics that affect construction include soil drainage, flooding, slope, depth to bedrock, texture, shrink-swell potential, and susceptibility to frost action.

Septic tank absorption fields.—Septic tank absorption fields are used to dispose of sewage where central sewage is unavailable. A system generally consists of a septic tank for holding solid wastes, a distribution box for dispensing effluent, and a tile disposal field. The entire system depends upon the ability of the soil to absorb and filter the liquid effluent passed through the tile field. Soil characteristics that impair proper absorption and filtering of the effluent cause health hazards as well as public nuisance situations. Soil characteristics affecting the operation of the tile absorption field include permeability, depth to seasonal high water table, flooding, slope, and depth to hard-rock, bedrock, or other impervious material.

Sewage lagoons.—These are shallow lakes used to hold sewage for the time required for bacterial decomposition. A suitable site should provide an impoundment area and enough soil material to make the dam structure. The completed lagoon must be able to hold water with minimum seepage and prevent contamination of water supplies. Soil characteristics affecting sewage lagoons are depth to seasonal high water table, permeability, depth to bedrock, slope, coarse fragments, organic-matter content, flooding hazard, and texture.

Sanitary landfill.—These are disposal areas for trash and garbage. The soils are rated for the trench type of landfill, with hauling of cover material unnecessary. A good sanitary landfill should operate without contaminating water supplies, reducing aesthetic land values, or causing health hazards. In addition they should be usable during all seasons of the year. Fill areas that have been adequately compacted and covered can be used for parking areas, parks, recreation areas, and other valuable uses. Soil characteristics affecting the establishment and operation of a sanitary landfill include depth to seasonal high water table, soil drainage, flooding, permeability, slope, texture, and depth to bedrock.

Routine soil investigations are normally confined to depths of about 5 to 6 feet and many landfill operations use trenches as deep as 15 feet or more. Therefore, there is a need for a geologic investigation of the area to determine the potential of pollution to ground water as well as to obtain the design of the landfill. The soil survey is a valuable tool in selecting potential sites and determining where additional investigations are needed.

In selecting a site for a particular use, the limitation rating given a named kind of soil, while important, is only one of the criteria a user should consider. Location, land value, aesthetic value, and population density are some other criteria. In some circumstances soil limitations can be modified or removed so that the soil can be used safely for the intended use. For this reason some kinds of soil rated as severe can be used for the intended use. This is especially important where good sites are scarce.

Trees and Shrubs for Environmental Improvement[4]

This section provides information on uses of trees and shrubs growing on soils of the county. Desirable species for certain soils and for specified uses are listed.

Tree covered areas in the county must be evaluated for their benefits to the community in addition to their value for producing wood crops. These areas have long-time value for the following uses:

Wind protection.—Scattered trees and wooded tracts tend to break up the regular pattern of the wind and to reduce its velocity.

[4] MITCHELL G. HASSLER, woodland conservationist, Soil Conservation Service, helped prepare this section.

Wildlife cover.—Islands of woody cover are essential for songbirds and many forms of wildlife to exist and reproduce.

Erosion reduction.—Tree cover is excellent for erosion control and in many locations serves as a filter strip for the streams and reservoirs of the county.

Recreation and education.—Wooded tracts provide sites for county parks, outdoor laboratories for schools, and nature study areas.

Air pollution reduction.—Trees are being recognized more each year for their role in reduction of air pollution. They release moisture and oxygen into the atmosphere and have a cooling and purification effect.

Environmental improvement.—Wooded tracts add scenic beauty to the county and help to create a healthful and pleasing environment.

In table 8 the soils of Hancock County have been placed in broad groups to give land users a good basis for planning the use of shrubs for environmental improvement. This table lists some of the trees and shrubs that grow naturally on each of the three soil groups and should be retained when developing an area for more intensive use for people. It also lists many trees and shrubs suitable for planting for a wide variety of environmental improvement projects. To determine which group a soil is in, use the "Guide to Mapping Units" at the back of this survey.

Table 8 does not have a complete listing of all plants that grow, or that are suitable for planting, on the various soils. Assistance in arranging plants, other materials suited to various sites, and source of plants should be obtained from local landscape architects, commercial nurseries, or forestry specialists.

Recreation

Outdoor recreational activity, already a major part of American life, is expected to triple by the year 2000. Outdoor recreation therefore should be an integral element in local land use planning (*5*). The location of Hancock County in relation to the expanding Indianapolis metropolitan area provides many possibilities for developing income producing recreational enterprises. The most likely enterprises are improved camping and picnic areas or ponds and lakes for fishing and water sports. Hunting areas and shooting preserves are other possibilities.

In table 9 the soils in Hancock County are rated according to their limitation for developing recreational facilities. The ratings are slight, moderate, and severe. For a rating other than slight, the degree of limitations of the soil for developing a specific recreational facility is also given. A rating of *slight* means the facility is easily created, improved, or maintained. There are few or no limitations that affect design or management. A *moderate* limitation means that the facility usually can be created, improved, or maintained, but there are moderate soil limitations that affect design of management. A rating of *severe* means that the practicality of establishing the facility is questionable. Extreme measures are needed to overcome the limitation and usage is generally unsound or not

TABLE 8.—*Suitability of the soils for trees and shrubs for environmental improvement*

Tree and shrub groups, descriptions of the groups, and soil series	Suitable trees to retain at home and park sites	Suitable plants for windbreaks, screens, and sound barriers	Suitable plants for beauty and shade	Suitable plants to attract songbirds and other wildlife
1: Deep, very poorly drained silty clay loams and clay loams, and nearly level, depressional mineral and organic soils; seasonal high water table at a depth of 0 to 1 foot; subject to ponding; subject to flooding in places. Brookston, Kokomo, Milford, Palms, Rensselaer, Sloan, and Westland.	White ash, pin oak, bur oak, red maple, sweetgum.	American arborvitae, Lombardy poplar, gray dogwood, redosier dogwood, silky dogwood, Amur honey-suckle, blue arctic willow, tall purple willow, medium purple willow.	American arborvitae, European larch, sourgum, sweetgum, river birch, pin oak, red maple, Lombardy poplar, weeping willow, black spruce.	American arborvitae, sourgum, pin oak, red maple, black spruce, gray dogwood, redosier dogwood, elderberry, Amur honeysuckle, buttonbush, trumpet creeper.
2: Deep, nearly level, somewhat poorly drained silt loams and loams; seasonal high water table at a depth of 1 foot to 3 feet; subject to occasional flooding in places. Crosby, Shoals, and Whitaker.	Tulip-poplar, white ash, pin oak, bur oak, red maple, swamp chestnut oak, sweetgum.	White pine, Norway spruce, white spruce, tulip-poplar, pin oak, basswood, autumn-olive, Amur honeysuckle, highbush cranberry, blackhaw, shadbush, arrowwood, Cornelian cherry, althea, cutleaf sumac.	White pine, white spruce, bald cypress, tulip-poplar, basswood, Cornelian cherry, cutleaf sumac.	White pine, Norway spruce, white spruce, tulip-poplar, pin oak, basswood, autumn-olive, Amur honeysuckle, highbush cranberry, spice bush, blackhaw, mapleleaf viburnum, shadbush, arrowwood, Cornelian cherry, cutleaf sumac, trumpet creeper, ground euonymus.
3: Deep, well drained and moderately well drained, nearly level silt loams, loams, and clay loams; high available water capacity; subject to occasional flooding in places. Eel, Genesee, Martinsville, Miami, and Ockley.	Black walnut, tulip-poplar, red oak, white ash, white oak, sugar maple, sycamore, cottonwood.	White pine, red pine, Norway spruce, hemlock, blackgum, honey locust, autumn-olive, Amur honeysuckle, highbush cranberry, blackhaw, shadbush, spindle tree, winged burning bush, lilacs, mockorange.	White pine, red pine, Norway spruce, hemlock, black locust, tulip-poplar, blackgum, honey locust, mountain ash, Norway maple, ginko, white birch, flowering dogwood, basswood, redbud, Cornelian cherry, spindle tree, winged burning bush, flowering crabapple, hawthorne, pachysandra.	Hemlock, black locust, Norway maple, white birch, flowering dogwood, basswood, redbud, autumn-olive, Amur honeysuckle, highbush cranberry, blackhaw, mapleleaf viburnum, shadbush, Corelian cherry, spindle tree, winged burning bush, flowering crabapple, hawthorne, mockorange, coralberry, Baltic ivy, ground myrtle.

TABLE 9.—*Degree of limitations and soil features affecting recreational use*

Soil series and map symbols	Campsites	Picnic grounds, parks, and extensive play areas	Playgrounds and athletic fields	Paths and trails	Golf course fairways
Brookston: Br	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.
Crosby: CrA	Moderate: somewhat poorly drained; slow permeability; slow to dry after rain.	Moderate: somewhat poorly drained; slow permeability; slow to dry after rain.	Severe: somewhat poorly drained; slow permeability; slow to dry after rain.	Moderate: somewhat poorly drained; slow permeability; slow to dry after rain.	Moderate: somewhat poorly drained; slow permeability; slow to dry after rain.
Eel: Ee[1]	Severe: floods during season of use.	Slight	Moderate: floods during season of use.	Slight	Severe: floods during season of use.
Genesee: Ge[1]	Severe: floods during season of use.	Slight	Moderate: floods during season of use.	Slight	Severe: floods during season of use.
Kokomo: Ko	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.
Martinsville: MaA, MaB2.	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent: slope hinders use for some games.	Slight	Slight.
Miami: MmA, MmB2, MmC2, MmD2, MpC3, MpD3.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders development. Severe where slopes are 12 to 18 percent: slope hinders development.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders development. Severe where slopes are 12 to 18 percent: slope hinders development.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent: slope hinders use for some games. Severe where slopes are 6 to 18 percent: slope hinders use for some games.	Slight where slopes are 0 to 12 percent. Moderate where slopes are 12 to 18 percent or in severely eroded areas: subject to erosion; clay loam surface of severely eroded areas affects foot trafficability.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders use; severely eroded areas affect foot trafficability. Severe where slopes are 12 to 18 percent: slope limits use; severely eroded areas affect foot trafficability.
Milford: Mr	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods; slow permeability.
Ockley: OcA, OcB2, OkC2.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders development.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders development.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent: slope hinders use for some games. Severe where slopes are 6 to 12 percent: slope hinders use for some games.	Slight	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent: slope hinders use.
Palms: Ps	Severe: very poorly drained; ponding; remains wet for long periods; organic material unsuitable for heavy foot traffic.	Severe: very poorly drained; ponding; remains wet for long periods; organic material unsuitable for heavy foot traffic.	Severe: very poorly drained; ponding; remains wet for long periods; organic material unsuited for heavy foot traffic.	Severe: very poorly drained; ponding; remains wet for long periods; organic material unsuitable for heavy foot traffic.	Severe: very poorly drained; ponding; remains wet for long periods; organic material unsuitable for heavy foot traffic.

Rensselaer: Re	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.
Shoals: Sh[1]	Severe: floods during season of use; somewhat poorly drained.	Moderate: floods during season of use; somewhat poorly drained.	Severe: floods during season of use; somewhat poorly drained.	Moderate: floods during season of use.	Severe: floods during season of use.
Sloan: So[1]	Severe: flooding; very poorly drained; remains wet for long periods.	Severe: very poorly drained; remains wet for long periods.	Severe: flooding; very poorly drained; remains wet for long periods.	Severe: very poorly drained; remains wet for long periods.	Severe: flooding; very poorly drained; remains wet for long periods.
Westland: We	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.	Severe: very poorly drained; ponding; remains wet for long periods.
Whitaker: Wh	Moderate: somewhat poorly drained; slow to dry after rains.	Moderate: somewhat poorly drained; slow to dry after rains.	Moderate: somewhat poorly drained; slow to dry after rains.	Moderate: somewhat poorly drained; slow to dry after rains.	Moderate: somewhat poorly drained; slow to dry after rains.

[1]Frequency and intensity of flooding extremely variable; onsite inspection required.

practical. The recreational uses for which the soils are rated in table 9 are described in the following paragraphs.

Campsites are areas suitable for tent and camp trailer sites and the accompanying activities of outdoor living. They are used frequently during the camping season. It is assumed that little site preparation is done other than shaping and leveling for tent and parking areas. The soils should be suitable for unsurfaced parking for camper trucks and camp trailers and for heavy foot traffic by humans and for limited vehicular traffic. Soil characteristics considered are wetness and flooding hazard, permeability, slope, surface layer texture, presence of coarse fragments, and stoniness or rockiness. Suitability of the soils for growing and maintaining vegetation was not considered in making these ratings, but it should be considered in the final evaluation of the site.

Picnic grounds, parks, and extensive play areas are areas suitable for heavy foot traffic and used by people for the consumption of food in a natural outdoor environment. It is assumed that most vehicular traffic is confined to access roads. Soil characteristics considered are wetness and flooding hazard, slope, surface layer texture, coarse fragments on the surface, stoniness, and rockiness. Ratings do not include features such as presence of trees or ponds, which may affect the desirability of a site. Suitability of soils for growing and maintaining vegetation was not considered in making these ratings, but it should be considered in the final evaluation of the site.

Playgrounds and athletic fields are areas used intensively for playgrounds for baseball, football, tennis, badminton, and other similar organized games. These areas are subject to intensive foot traffic and generally require a level surface, good drainage, and texture and consistence that gives a firm surface. The most desirable soils are free of rock outcrop and coarse fragments. Soil characteristics considered are wetness and flooding hazards, permeability, slope, surface layer texture, depth to bedrock, presence of coarse fragments, and stoniness or rockiness. Suitability of soils for growing and maintaining vegetation was not considered in making these ratings, but it should be considered in the final evaluation of the site.

Paths and trails are areas suitable for use as local and cross-country foot paths and trails and as bridle paths. It is assumed that these areas are to be used as they occur in nature and that little or no soil will be moved (excavated or filled) in preparation for this recreational use. Soil features that affect trafficability, dust, design, and maintenance of trafficways are given special emphasis. Soil characteristics considered are wetness and flooding hazards, slope, surface soil texture, presence of coarse fragments on the surface, and rockiness or stoniness. Many soils that have severe limitations for paths and trails are the most interesting from an esthetic viewpoint. A rating of severe indicates a path or trail will be costly to build and maintain but should not preclude its construction.

In evaluating soils for golf courses, only those features that influence the use of disturbed soils as fairways were considered. Greens, traps, and hazards are generally constructed from disturbed, transported soil material. For best use, fairways should be well drained and firm, be free of flooding during periods of use, have good trafficability, contain a minimum of coarse fragments or stones, and be gently undulating. They should be capable of supporting a good turf and be well suited to many kinds of trees and shrubs. Loamy soils are best, but coarser textured soils serve equally well if irrigated. Poorly drained mineral soils have severe limitations, but they can be used for pond sites to provide esthetic value or for storing water for turf maintenance. Sandy soils likewise can be designed for hazards or used as a source of sand for greens. Soil characteristics considered are depth to seasonal high water table, soil drainage, surface stoniness or rockiness, flood hazard, surface texture, and slope.

Formation and Classification of the Soils

In this section the factors that have affected the formation of soils in Hancock County are discussed. Then the current system of soil classification is explained and the soils are placed in higher categories. The soil series in the county, including a profile representative of each series, are described in the section "Descriptions of the Soils." The last part of this section provides laboratory data pertaining to the physical properties and reaction of selected soils in Hancock County.

Factors of Soil Formation

Soil-forming processes act on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, or lay of the land, and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rock and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determine it almost entirely. Finally, time is needed to change the parent material into a soil profile. Some time is always required for differentiation of soil horizons. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material

The soils in Hancock County formed in parent material derived from glacial till, glacial outwash, lacustrine material, alluvial material, and windblown material. The underlying bedrock, which is mostly limestone, has not had much direct influence on the formation of the soils in this county.

Glaciers have been an important factor in the formation of the soils of Hancock County. These huge sheets of ice, thousands of feet thick, moved out of Canada and over this county at least three times during stages or periods of glaciation. These stages were, from oldest to youngest, the Kansan, Illinoian, and Wisconsin.

As the ice moved southward, it destroyed old hills and valleys and made new ones. A mantle of unconsolidated material made up of rock, sand, silt, and clay was left when the ice melted and receded. This material, called glacial drift, includes till and outwash. Glacial till is a compact loamy mixture of sand, silt, clay, and gravel. Outwash is water-laid deposits, mainly sand and gravel.

Hancock County is in the central part of Indiana, in the relatively flat upland area called the Tipton Till Plain. Glacial and postglacial streams dissected the till plain, cutting valleys 20 to 60 feet deep into the glacial drift. The present landforms in the county are a result of glaciation and minor postglacial erosion. When glaciers were melting, windstorms deposited a thin mantle of windblown silt called loess. In most areas of the county the silt is less than a foot thick and has no major effect on the formation of the soils other than the texture of the surface layer.

The upland soils formed in alkaline calcareous till material that ranges from loam to light clay loam in texture. The light-colored Crosby soils formed in the nearly level landscape swells, the dark-colored Brookston and Kokomo soils formed in the swales or depressions, the Miami soils formed on the rolling uplands, and along the breaks of rivers and streams.

The soils that formed in water-laid material are variable. Some soils formed in outwash that contains a considerable amount of sand and gravel, and others formed in silt and fine sand. The outwash was deposited by melt water when the glacier retreated. The type of material deposited depended on the speed of the flowing water. The glacial streams cut valleys across the county in a general northeast-to-southwest pattern.

The Ockley and Westland soils formed partly from the underlying sand and gravel, but the upper part appears to have formed from finer textured material. The Rensselaer, Whitaker, and Martinsville soils formed in the stratified silt and fine sand deposited.

The Milford soils formed in silt and clay lacustrine material that settled out of the still waters of shallow lakes, ponds, and marshes left by the glacier. In some ponded areas, the Palms soils formed in the organic matter that accumulated.

The Genesee, Eel, Shoals, and Sloan soils are on the flood plains of streams and rivers. These are young soils that formed in recent deposits of alluvium deposited by floodwater.

Climate

Hancock County has a midcontinental climate that is essentially uniform throughout the county. Winters are cold, and summers are warm. The average daily maximum is 37° F in January and 87° in July, and it is 63° for the year. The precipitation is fairly well distributed throughout the year but is slightly greater in spring. The mean annual precipitation is 39.9 inches.

Climate influences the formation of soils in the county largely through moderately heavy precipitation. The rain and melting snow seep slowly downward through the soils and cause physical and chemical changes. Physically, the percolating water removes the clay particles from the surface layer and translocates them to the subsoil. Accumulation of clay in the subsoil is characteristic of most soils in the county. Percolating water dissolves minerals and moves them downward through the soils. As a result of this leaching, free calcium carbonate has been removed from the surface layer and subsoil of most of the soils in Hancock County, and those layers are slightly acid to medium acid.

The soils in the survey area are frozen for 3 or 4 months each year. During this period the soil-forming factors are mainly inactive except for some freezing and thawing action.

Climate indirectly influences the formation of soils by stimulating the growth of living organisms, especially vegetation. The climate of Hancock County is conducive to growth of hardwoods, which directly influences the formation of soils. Since the climate is uniform throughout the county, it is not a major factor causing differences among the soils.

A more detailed account of the climate of Hancock County is given in the section "General Nature of the County."

Plant and animal life

Before this county was settled, the native vegetation was most important in the complex of living organisms that affect soil formation. Plants, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its morphology. Bacteria and fungi are micro-organisms that affect the soils. They cause raw plant waste to decompose into organic matter and to be incorporated into the soil. The higher forms of plants return organic matter to the soil and bring moisture and plant nutrients from the lower part of the profile to the upper part.

The native vegetation in this county is largely hardwoods. The most common species were beech, maple, oak, hickory, tulip-poplar, elm, and ash. Small amounts of organic matter from the forest become incorporated in the soils while they are forming. In forested areas of uplands that have never been cleared, thin layers of forest litter and leaf mold cover the soils. A small amount of organic matter from decayed leaves and twigs is mixed into the upper 1 to 2 inches of the surface layer.

In areas of very poorly drained soils, the native vegetation included swamp grasses and sedges, as well as water-tolerant trees. These soils were covered with water much of the time, and, as the organic material fell into the water, it decayed slowly and some of it accumulated. Palms muck is in areas where the organic matter accumulation is more than 16 inches thick.

The vegetation is fairly uniform throughout the county. Major differences in the soils, therefore, cannot be explained on the basis of differences in vegetation. Although some comparatively minor variations in the vegetation are associated with different soils, these variations are probably chiefly the result of, not the cause of, the difference in soils.

Relief

The relief of Hancock County is mostly nearly level. The bottom lands and most of the uplands and terraces are nearly level. The breaks between the uplands and the lower terraces and bottom lands are the areas of greatest relief, but some relief occurs in a few rolling areas of the uplands. Most of the county is somewhat dissected by streams and waterways. The highest point in Hancock County is about 1,030 feet above sea level and is near Shirley. The lowest point is about 780 feet above sea level where Sugar Creek leaves the county.

Variations in relief have affected the drainage and formation of soils of the county. The influence of relief upon soil formation comes from its controlling effect upon drainage, runoff, and other water effects including normal and accelerated erosion.

In Hancock County, differences in relief affected moisture and air conditions within the soils. The profiles of soils that formed in the same type of parent material are less strongly developed in strongly sloping areas than those in nearly level areas. This difference in soil development is caused by rapid normal erosion, reduced percolation of water through the soil material, and lack of water in the soil that accelerates chemical reactions and promotes vigorous growth of plants. The degree of profile development within a given time, on a given parent material, and under the same type of vegetation depends largely on the amount of water that passes through the soil material.

Because of the variation of relief in this county, several different soils have formed from the same kind of parent material. A good example of the way relief has affected soils that formed in the same kind of parent material is the Miami catena of soils that formed in till. Miami soils are sloping to moderately steep, well drained, brown to dark brown, and moderately slowly permeable. Crosby soils are nearly level and slowly permeable, and have a reddish and grayish, mottled subsoil. The dark-colored Brookston soils formed in slight depressions and have a gray subsoil.

Time

Time determines, to a great extent, the age of a soil or the degree of profile development. Because of differences in parent material, relief, and climate, some soils mature more slowly than others. The influence of time may be modified by erosion, deposition of material, topography, and kind of parent material. Surface erosion and mass movement of superficial material cause some removal and disturbance, even where slopes are gentle. Soils that formed on recent alluvium or on steep slopes where erosion has been more active, show little development and can be thought of as young soils. A mature soil has well-defined, genetically related horizons because the rate of soil formation has exceeded the rate of erosion. These soils have well-developed A horizons and B horizons that were produced by the leaching of carbonates and bases, the translocation of clay minerals, and the oxidation or reduction of iron compounds. Miami soils are mature. Genesee soils formed in recent alluvium. They show little horizon development and are immature or young soils.

Processes of Soil Formation

Four major processes were involved in the formation of horizons in the soils of this county. These processes are the accumulation of organic matter, the leaching of calcium carbonates and bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in the development of horizons.

The accumulation of organic matter in the upper part of the profile to form an A1 horizon has been important. In general, soils that contain much organic matter have a thick, dark-colored surface layer.

Carbonates and bases have been leached from the upper horizons of nearly all of the soils of this county. This leaching is generally believed to precede the translocation of silicate clay minerals.

Clay particles accumulate in pores and other voids and form films on the surface along which water moves. Leaching of bases and the translocation of silicate clays are among the more important processes in horizon differentiation in the soils of this county. Soils of the Miami series are examples of soils in which translocated silicate clays have accumulated in the B2t horizon in the form of clay films.

The reduction and transfer of iron, or gleying, is evident in some of the very poorly drained soils, such as those of the Brookston series. The gray color of the subsoil indicates the reduction and loss of iron. Mottles, which occur in some horizons, indicate segregation of iron.

Laboratory Data[5]

The physical and chemical properties of the Kokomo, Martinsville, Milford, Sloan, and Whitaker soils in Hancock County are shown in table 10. Samples of these soils were selected for analyses during the period 1971-73. Except for the Sloan silty clay loam, samples are from the respective profiles described in the section "Descriptions of the Soils." The Sloan soil is from a typical profile very similar to the one described as representative of the Sloan series. Analyses for particle-size distribution and for organic-carbon content were determined in the Purdue laboratory, and those for reaction, extractable phosphorus, and extractable potassium were determined by the Purdue Plant and Soil Analysis Laboratory.

All samples were taken from carefully selected pits. Each soil sample was thoroughly mixed, air dried, and crushed by hand or by a rolling pin. Coarse fragments more than 2 millimeters in size were removed from the sample and recorded as a volume estimate or as a weighed percentage of the sample. The soil material that subsequently passed through a 2-millimeter, round-hole sieve was used for laboratory analyses. All results in table 10 are reported on an ovendry basis. Methods that were used in obtaining the data are described as follows.

In the size class and particle diameter analyses, organic matter in the sample was destroyed if the organic-carbon content was more than 2 percent. Clay content was determined after dispersion of the sample by a sodium metaphosphate solution and overnight shaking. Following the clay determination, the suspension was passed through selected sieves to separate particles of various sizes and the separated fractions were dried and weighed. The percentage of silt was determined by weight difference. All size classes in table 10, unless noted otherwise, are reported on the basis of the less than 2-millimeter soil material.

The textural class and pH values given in table 10 may differ somewhat from those estimates in the field and recorded in the profile descriptions.

Organic carbon was determined by the Walkley-Black method, the acid-dichromate digestion and ferrous sulfate titration of the oxidizable organic carbon.

Soil reaction, expressed as a pH value, was obtained by using a glass electrode pH meter and a 1:1 soil-water suspension.

Extractable phosphorus was determined by the Bray P-1 test. The soil was leached with a 0.025 normal hydrochloric acid and 0.3 normal ammonium fluoride solution, and phosphorus was determined by the molybdo-phosphoric blue colorimetric method.

Extractable potassium was extracted with neutral, normal ammonium acetate and determined using an atomic absorption spectrophotometer.

The phosphorus and potassum determinations are reported as pounds per acre. It was assumed that the plow layer for an acre of soil weighs 2,000,000 pounds.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed

[5] DR. DONALD P. FRANZMEIER, associate professor of agronomy, Purdue University, assisted in preparation of this section.

in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*9*). Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. The same property or subdivisions of this property may be used in several different categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. Three exceptions to this are the Entisols, Histosols, and Vertisols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Moll-i-sol).

SUBORDER: Each order is subdivided into suborders using those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders are more narrowly defined than are the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of a water table at a shallow depth; soil climate; the accumulation of clay, iron, or organic carbon in the upper solum; cracking of soils caused by a decrease in soil moisture; and fine stratification. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquoll* (*Aqua,* meaning water or wet, and *oll,* from Mollisol).

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of soil horizons and features. The horizons used to make separations are those in which clay, carbonates, and other constituents have accumulated or have been removed; and those that have pans that interfere with growth of roots, movement of water, or both. Some features used are soil acidity, soil climate, soil composition, and soil color. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquoll (*Hapl,* meaning simple horizons, *aqua* for wetness or water, and *oll,* from Mollisols).

SUBGROUP: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Other subgroups may have soil properties unlike those of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplaquolls (a typical Haplaquoll).

FAMILY: Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, soil depth, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives represent the class names for texture, mineralogy, and soil temperature that are used as family differentiae (see table 11). An example is the coarse-loamy, mixed, mesic family of Typic Haplaquolls.

SERIES: The series is a group of soils that formed from a particular kind of parent material and have major horizons that, except for the texture of the surface layer, are similar in important characteristics and in arrangement in the profile. The soils are given the name of a geographic location near the place where that series was first observed and mapped.

General Nature of the County

This section contains information about the history; physiography, relief, and drainage; climate; water supply, transportation, and industry; and farming in Hancock County.

History

Hancock County was originally inhabited by Indians from the Miami and Potawatomi Tribes. The first settlers settled in Blue River Township in 1818. Early settlements were built along the streams, which provided water and power for small mills. The first farms were on well-drained soils along the streams. It was not until ditches and tile were used for drainage that the poorly drained, nearly level soils on uplands could be farmed.

Hancock County was created on March 1, 1828. It was named after John Hancock, the first signer of the Declaration of Independence. The population of the county was 35,096 in 1970 and is expected to be more than 40,000 by 1980. Greenfield, the county seat, is the largest city in the county. It has a population of about 10,000 people. It is located near the center of the county where the old National Road, which was built in 1835, crossed Brandywine Creek.

Physiography, Relief, and Drainage

All of Hancock County is on the Tipton Till Plain (*4*), which forms part of the Central Lowland Province of the United States (*3*). The whole county is characterized by relatively small differences in relief. Glaciation was the principal factor responsible for the present landform, not the underlying bedrock. Only slight changes have been made by post-Wisconsin glacial streams. The most relief is along the breaks between the nearly level uplands and the bottom lands of the streams that drain the county.

The difference in elevation throughout the county is only about 250 feet. The highest point, about 1,030

TABLE 10.—*Physical and chemical*

Soil name and location	Depth	Horizon	Textural class	Size class and particle diameter			
				Very coarse sand to fine sand (2.0 to 0.1 mm)	Very coarse sand (2.0 to 1.0 mm)	Coarse sand (1.0 to 0.5 mm)	Medium sand (0.5 to 0.25 mm)
	Inches						
Kokomo silty clay loam: NW¼ sec. 14, T. 15 N., R. 6 E.	0–9	Ap	Silty clay loam	11.8			
	9–11	A12	Silty clay loam	11.5			
	11–14	B1g	Silty clay loam	9.7			
	14–21	B21tg	Silty clay loam	7.5			
	21–29	B22tg	Silty clay loam	5.6			
	29–38	B23tg	Silty clay loam	3.7			
	38–44	IIB3	Loam	22.2			
	44–60	IIC	Loam	27.6			
Martinsville loam: SW¼ sec. 24, T. 17 N., R. 6 E.	0–8	Ap	Loam	24.1	3.2	3.2	4.2
	8–13	A2	Silt loam	14.5	.8	1.5	2.9
	13–25	B21t	Clay loam	15.6	.8	1.0	2.5
	25–32	B22g	Sandy clay loam	18.5	.3	.2	.6
	32–40	B23g	Sandy loam	25.4	.2	.2	.2
	40–50	B3	Sandy loam	31.2	.2	.2	.5
	50–54	C1	Loamy sand	33.3	.1	.3	.8
	54–81	C2	Sandy loam	13.8	.1	.2	.3
Milford silty clay loam: NW¼ sec. 29, T. 17 N., R. 8 E.	0–9	Ap	Silty clay loam	1.3			
	9–12	B21g	Silty clay	.6			
	12–21	B22g	Silty clay	.5			
	21–36	B23g	Silty clay loam	.3			
	36–40	B3	Silty clay loam	.1			
	40–45	C1	Silty clay loam	.3			
	45–61	C2	Silty clay loam	.8			
Sloan silty clay loam: SW¼ sec. 19, T. 16 N., R. 6 E.	0–5	Ap	Loam	25.6			
	5–12	A12	Loam	5.8			
	12–19	B21g	Loam	22.4			
	19–24	B22g	Clay loam	21.7			
	24–37	B23g	Clay loam	23.1			
	37–47	B3g	Clay loam	24.3			
	47–63	C1	Loam	28.7	2.8	3.3	9.2
	63–72	C1	Sandy loam	71.3	10.0	20.4	26.5
Whitaker loam: NW¼ sec. 24, T. 17 N., R. 6 E.	0–9	Ap	Loam	35.2	2.9	3.2	10.9
	9–11	A2	Loam	38.4	3.2	2.0	10.1
	11–24	B21t	Clay loam	23.8	.8	1.0	5.7
	24–33	B22t	Loam	32.3	1.2	1.1	7.7
	33–39	B3t	Sandy loam	59.1	1.9	3.9	16.6
	39–56	C1	Sandy loam	44.0	.3	7.1	10.2
	56–64	C2	Sandy loam	43.7		.1	5.5

feet, is near Shirley in the northeast part of the county. The lowest point, about 780 feet, is on the bottom lands of Sugar Creek where it leaves the county in the southwestern part.

The general drainage pattern is from northeast to southwest. Sugar Creek, which drains most of Hancock County, runs from the northeastern part of the county to the southwestern part. Brandywine Creek drains the central part. Blue River and its tributaries drain the eastern part, and Buck Creek the western part.

Drainageways in the nearly level upland till plain are weak or undeveloped. Natural drainage of the area is poor, and marshes and swamps were common before artificial drainage systems were installed. Initially, open ditches were dug to drain the wet areas. Later, underground tile drains were installed. Open ditches and tile drains are necessary for crop production on most farms.

Climate[6]

Hancock County has a humid continental climate and is on the fringe of the area that is influenced by the weather of the Great Lakes. The invigorating climate results from the flow of cool Canadian airmasses alternating with tropical airmasses from the south to bring weather changes within days and a variability of the seasons.

Rainfall is generally adequate during the growing season for diversified farming, but in midsummer evaporation from the soils exceeds rainfall for brief

[6] By LAWRENCE A. SCHAAL, climatologist for Indiana, National Weather Service, U.S. Department of Commerce.

properties of selected soils

Size class and particle diameter						Organic carbon	Reaction (1:1 soil-water suspension)	Extractable	
Fine sand (0.25 to 0.1 mm)	Very fine (0.10 to 0.05 mm)	Silt (0.05 to 0.002 mm)	Clay (less than 0.002 mm)	Total sand (2.0 to 0.05 mm)	Coarse fraction (more than 2.0 mm)			Phosphorus	Potassium
				Percent	*Percent of whole soil*	*Percent*	*pH*	*Pounds per acre*	*Pounds per acre*
	5.6	49.3	33.3	17.4		2.28	6.8	21	225
	5.5	49.2	33.8	17.0		2.11	6.7	24	225
	4.8	49.1	36.4	14.5		.96	6.8	4	180
	4.2	51.1	37.2	11.7			6.9	4	225
	3.3	51.5	39.6	8.9	1.0		7.2	2	240
	2.6	58.9	34.8	6.3			7.5	2	210
	10.8	48.6	18.4	33.0	2.2		8.0	2	135
	10.5	41.5	20.4	38.1	5.2		8.0	2	105
13.5	15.0	46.0	14.9	39.1			7.6	25	135
9.3	10.5	62.1	12.9	25.0			7.7	7	105
11.3	15.0	40.8	28.6	30.6			7.1	6	195
17.4	33.8	27.0	20.7	52.3			7.5	10	165
24.8	39.6	18.3	16.7	65.0			7.6	17	150
30.3	37.2	14.5	17.1	68.4			7.6	33	150
32.1	41.1	17.3	8.3	74.4			7.2	10	75
13.2	45.6	38.6	2.0	59.4			8.4	2	30
	1.4	58.8	38.5	2.7		3.2	7.8	106	180
	.9	54.5	44.0	1.5		2.0	7.3	11	165
	.7	58.3	40.5	1.2		1.0	7.7	6	150
	.6	65.3	33.8	.9			7.7	11	225
	.4	68.1	31.4	.5			7.8	11	240
	.7	69.0	30.0	1.0			7.9	4	240
	1.2	68.7	29.3	2.0			8.1	1	165
	7.7	41.1	25.6	33.3		2.0	7.5	58	210
	7.4	41.5	25.3	33.2		2.0	7.7	27	165
	7.1	44.5	26.0	29.5		.99	7.5	14	180
	6.6	43.3	28.4	28.3		.75	7.2	19	180
	7.3	42.2	27.4	30.4			7.1	15	180
	7.5	41.0	27.2	31.8			7.4	30	195
13.4	6.0	38.7	26.6	34.7	4.0		7.5	22	195
14.4	7.6	6.4	14.7	78.9	12.6		7.8	8	60
18.2	7.6	44.5	12.7	42.8			7.1	12	90
23.0	7.0	36.7	17.9	45.4			6.8	4	105
16.3	5.9	38.3	32.0	29.7			5.8	4	195
22.3	7.0	35.1	25.6	39.3			6.7	2	180
36.7	5.0	16.1	19.8	64.1			6.8	3	165
16.4	8.0	32.7	15.3	52.0	10.0		8.2	3	105
38.1	26.9	24.3	5.1	70.6			8.4	4	45

TABLE 11.—*Classification of soil series*

Series	Family	Subgroup	Order
Brookston	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Crosby	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Eel	Fine-loamy, mixed, nonacid, mesic	Aquic Udifluvents	Entisols.
Genesee	Fine-loamy, mixed, nonacid, mesic	Typic Udifluvents	Entisols.
Kokomo	Fine, mixed, mesic	Typic Argiaquolls	Mollisols.
Martinsville	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Miami	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Milford	Fine, mixed, mesic	Typic Haplaquolls	Mollisols.
Ockley	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Palms	Loamy, mixed, euic, mesic	Terric Medisaprists	Histosols.
Rensselaer	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Shoals	Fine-loamy, mixed, nonacid, mesic	Aeric Fluvaquents	Entisols.
Sloan	Fine-loamy, mixed, mesic	Fluvaquentic Haplaquolls	Entisols.
Westland	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Whitaker	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.

periods, occasionally affecting lawns, pasture, and crops.

Weather changes every few days come from the passing of weather fronts and associated centers of low and high air pressure. In general, a high brings lower temperatures, lower humidity, and sunshine. An approaching low brings higher temperatures, stronger southerly winds, higher humidity, and rain or showers. This activity is greatest in winter and spring and least late in summer and early in fall. Arctic airmasses cover the county much of the winter. Tropical airmasses prevail in summer.

Temperature in a 30-year period has ranged from −18° to 109° F. Days with a temperature of 90° F or higher averaged 34 a year, and days continually below freezing averaged 28. Data on temperature and precipitation are given in table 12. These data, recorded at Greenfield, are considered representative for the county.

Average annual precipitation is rather evenly distributed throughout the year, but rain in spring and early in summer generally exceeds the precipitation in winter. The rain in spring is considered to be reliable, and it generally ensures nearly maximum soil moisture when the growing season begins and offers some insurance against a drought in summer. Sometimes wet fields in spring delay planting operations. The least precipitation generally occurs in winter.

Snowfall averages 22 inches a year. In December through March it averages 5 inches each month. In 1960, snowfall totaled 16 inches in March. In a 30-year period the extreme 1 day snowfall was 8 inches on March 10, 1949. Snow is generally welcomed by farmers to protect winter grain from the severe cold that invariably follows.

Cloud observations at Indianapolis, which are representative for Hancock County, show that 172 days out of 365 are cloudy and 91 days are clear. The sun shines for 59 percent of the daylight hours. This percentage ranges from 40 in December to 72 in August.

Relative humidity at noon averages from about 58 percent in summer to 68 percent in winter. On most nights relative humidity increases to the 90's and is accompanied by frequent dew or frost.

Winds are most frequently from the southwest; however, in a couple of winter months they are dominantly from the northwest. The average velocity of these winds 20 feet above the ground ranges from 7 miles per hour in September to 11 miles per hour in winter and early in spring. Damaging winds may accompany thunderstorms or tornadoes. In a 53-year period 9 tornadoes were reported passing through the county. Thunderstorms, including incidences of lightning and thunder, occur on about 44 days a year.

Growing season weather generally favors farming in the county (table 13).

Water Supply

The water supply for farms, homes, and industry comes from wells. Most of the county has a good source of ground water within 150 feet of the surface, and many wells are less than 50 feet deep. The streams in the county are a good source of water, but they are not being used.

Transportation and Industry

The first National Road was built through Hancock County from east to west in 1835. It was later replaced by US-40 and is now parallel with Interstate 70. State Road 9 is the main north-south highway. Other important highways are US-52, US-36, and State Roads 13, 234, 67, and 109.

TABLE 12.—*Temperature and precipitation*

[All data from Greenfield; period of record 1939-73; elevation 900 feet (*10*)]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly maximum	Average monthly minimum	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with snow cover of 1 inch or more	Depth of snow on days with snow cover of 1 inch or more
	°F	*°F*	*°F*	*°F*	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	37	20	59	−4	2.9	0.8	6.3	10	2.3
February	40	22	61	1	2.4	.6	4.0	7	2.4
March	50	29	67	12	3.5	1.2	7.0	4	3.5
April	63	41	82	25	4.0	1.3	6.2	.2	1.8
May	74	51	88	35	4.4	1.0	8.4	0	0
June	83	60	94	46	4.2	1.3	7.1	0	0
July	87	63	95	51	4.3	1.5	8.8	0	0
August	85	61	95	49	3.0	1.3	5.1	0	0
September	79	54	92	38	3.1	1.0	6.3	0	0
October	68	44	84	28	2.6	.4	5.3	0	0
November	51	33	71	15	3.0	1.3	4.9	1	2.2
December	39	23	61	3	2.5	.7	4.5	9	2.2
Year	63	42	[1]97	[2]−7	39.9	29.9	49.3	31	2.4

[1]Average annual highest temperature.

[2]Average annual lowest temperature.

TABLE 13.—*Probabilities of last freezing temperatures in spring and first in fall*
[All data from Greenfield (*10*)]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 24	April 1	April 17	May 1	May 11
2 years in 10 later than	March 18	March 26	April 11	April 26	May 6
5 years in 10 later than	March 5	March 14	March 30	April 14	April 27
Fall:					
1 year in 10 earlier than	November 9	November 5	October 22	October 13	September 30
2 years in 10 earlier than	November 16	November 10	October 27	October 18	October 6
5 years in 10 earlier than	December 2	November 20	November 6	October 29	October 16

The county is well served by railroads.

There are small airports at Greenfield and McCordsville and several small private landing strips throughout the county. There is a large airport facility being planned north of Mt. Comfort.

There are several small industries in the county, but industry in the county has grown slowly. The largest industry in the county, just west of Greenfield, does research in pharmacology. Many residents work in factories in Indianapolis or Anderson, outside the county.

Farming

The farms of Hancock County are some of the most productive in the State. The farms mainly produce cash grain, livestock, and some dairy products. According to the 1969 Census of Agriculture, about 171,320 acres of Hancock County is in farms. This acreage is decreasing each year because of the increase in residential developments in the county. Economic reasons have caused a decrease in the number of farms and an increase in the size of farms. In recent years more fields are going into grain production and the livestock is being kept in feedlots.

In 1959, according to the 1964 Census of Agriculture, about 46,000 acres produced about 4,500,000 bushels of corn, 45,700 acres produced about 1,500,000 bushels of soybeans, and 7,700 acres produced about 316,000 bushels of wheat. In recent years more acreage is being planted to wheat in fall and then being planted to soybeans, right after the wheat harvest.

Hogs are the main livestock produced in the county, followed by feeder cattle and dairy cattle.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base (chemistry). Any of the positive, generally metallic elements that make up the nonacid plant nutrients. The most important of these in plant nutrition are calcium (Ca), potassium (K), magnesium (Mg), and ammonium (NH_4).

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drift (geology). Material of any sort deposited by geologic processes in one place after having been removed from another; includes drift materials deposited by glaciers and by streams and lakes associated with them.

Effluent. The outflow of water from a subterranean storage space. The term is also used in reference to gases and other liquids.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or a catastrophe in nature, for example, fire, that exposes a bare surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Friability. Term for the ease with which soil crumbles. A friable soil is one that crumbles easily.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Legume. A member of the legume or pulse family (Leguminosae). One of the most important and widely distributed plant families. Includes many valuable forage species, such as peas, beans, peanuts, clover, alfalfa, sweetclover, lespedeza vetch, and kudzu. Practically all legumes are nitrogen-fixing plants, and many of the herbaceous species are used as cover and green-manure crops. Even some of the legumes that have no forage value (crotalaria and some lupines) are used for soil improvement. Other legumes are locust, honeylocust, redbud, mimosa, wisteria, and many tropical plants.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter and along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch; and coarse, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.0 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structures are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes the A1 or Ap A, horizons; has no depth limit.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbeds, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Watertable, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. In referring to a capability unit, read the introduction to the section it is in for general information about its management.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group	Tree and shrub group
			Symbol	Page	Number	Number
Br	Brookston silty clay loam	7	IIw-1	25	2w11	1
CrA	Crosby silt loam, 0 to 3 percent slopes	8	IIw-2	25	3w5	2
Ee	Eel silt loam	9	I-2	25	1o8	3
Ge	Genesee silt loam	10	I-2	25	1o8	3
Ko	Kokomo silty clay loam	11	IIw-1	25	2w11	1
MaA	Martinsville loam, 0 to 2 percent slopes	12	I-1	24	1o1	3
MaB2	Martinsville loam, 2 to 6 percent slopes, eroded	12	IIe-1	25	1o1	3
MmA	Miami silt loam, 0 to 2 percent slopes	14	I-1	24	1o1	3
MmB2	Miami silt loam, 2 to 6 percent slopes, eroded	14	IIe-1	25	1o1	3
MmC2	Miami silt loam, 6 to 12 percent slopes, eroded	14	IIIe-1	27	1o1	3
MmD2	Miami silt loam, 12 to 18 percent slopes, eroded	14	IVe-1	28	1o1	3
MpC3	Miami complex, 6 to 12 percent slopes, severely eroded	15	IVe-1	28	1o1	3
MpD3	Miami complex, 12 to 18 percent slopes, severely eroded	15	VIe-1	28	1o1	3
Mr	Milford silty clay loam	16	IIw-1	25	2w11	1
OcA	Ockley silt loam, 0 to 2 percent slopes	17	I-1	24	1o1	3
OcB2	Ockely silt loam, 2 to 6 percent slopes, eroded	17	IIe-3	25	1o1	3
OkC2	Ockley complex, 6 to 12 percent slopes, eroded	17	IIIe-9	27	1o1	3
Ps	Palms muck	18	IIw-10	26	4w23	1
Re	Rensselaer silty clay loam	19	IIw-1	25	2w11	1
Sh	Shoals silt loam	20	IIw-7	26	2w13	2
So	Sloan silty clay loam	21	IIIw-9	27	2w11	1
We	Westland clay loam	22	IIw-1	25	2w11	1
Wh	Whitaker loam	23	IIw-2	25	3w5	2

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